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71	Optimization of CNC turning using ann and fuzzy logic	May 2008
72	Integrated maintenance and production scheduling using Evol. algorithms	May 2008
73	Selection of Partners in Extended enterprise using Evol. Algorithms	May 2008
74	Multi-criteria decision making in multi echelon supply chain -NSGAII	May 2008
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78	Evaluation of manufacturing strategy	Dec 2008
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81	Resource allocation in projects using nontraditional techniques	May2009
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83	Manufacturing strategy analysis by simulation	May2009
84	Case study on life cycle costing Analysis	May2009
85	Optimization of EDM parameters using ANN and GA	May 2009
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87	Performance Measurement of supply chain using DEA and MCDM	Dec 2009
88	Facility Location using multi criteria decision making techniques	Dec 2009
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90	Facility Location Selection using MCDM methods and K Means	May 2010
91	Measuring Performance of Supply chain using DEA and MCDM	May 2010
92	Selection of Maintenance strategy using MCDM methods and Clustering.	May 2010
93	Modeling and analysis of assembly sequence planning	Dec 2010
94	Some algorithms for process plan selection	Dec 2010
95	Prediction of quality in submerged arc welding using ANN and FIS	Dec 2010
96	Multicriteria decision making approach for supplier selection	Dec 2010
97	Process Plan selection using Petri nets	May 2011
98	Design and analysis of heat exchanger using CFD	May 2011
99	Modeling the heat exchanger parameters using artificial neural networks	May2011
100	"WELD_PRO": A knowledge-based system for welding process selection	May 2011
101	An integrated model for supplier selection and evaluation	May 2011
102	Assembly sequencing and line balancing using Petri nets	May 2011
103	An integrated model for knowledge-based product lifecycle management	Dec 2011
104	Flexibility as a performance measure In supply chain using simulation	Dec 2011
105	Performance measurement in Maintenance	Dec 2011
106	A dynamic decision support system for new Product Development	May 2012
107	Measuring responsiveness of supply chain using simulation	May 2012
108	Measuring the influence of human factor in maintenance	May 2012
109	Maintenance Scheduling for Power Systems	Dec 2012
110	Customization of Material Requirement Planning (MRP) Module in SAP	Dec 2012
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112	ECM Process Optimization Using D.O.E and Multiple Regression	Dec 2012
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117	Implementation of total productive maintenance for management	Dec 2013
118	Ranking of technicians in a field service environment to allocate the best	Dec 2013
119	Process characteristics of ECM of Titanium alloy	Dec 2013
120	Development of performance measurement system for a maintenance	May 2014
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122	Process characteristics of Electrochemical Machining of Incoloy 800HT	May 2014
123	Implementation of sustainable manufacturing tools	May 2014
124	Facility layout optimization using linear and non-linear mixed integer	Dec 2014

125	Field service scheduling using mixed integer programming	Dec 2014
126	Maintenance strategies selection fuzzy FMEA and integer programming	Dec 2014
127	Decision making on call performance using statistical analysis software	May 2015
128	Multiperiod field service scheduling using MINLP	May 2015
129	Fault diagnosis using case based reasoning	May 2015
130	Cost control in a storage installation for petroleum products	Dec 2015
131	Optimization of downstream supply chain with multiple time periods	May 2016
132	Investigation on machinability of superalloy inconel 617	Dec 2016
133	New paradigm for inventory management in industries	Dec 2016
134	**L**ife cycle assessment for a process industry	Dec 2016
135	Selection of maintenance strategy for a process industry	Dec 2016
136	Investigation on profile cutting of Superalloy using non-traditional process	May 2017
137	Life Cycle Assessment for Power Plants	May 2017
138	Risk management in service industry	May 2017
139	Time Based Vendor Managed Inventory Systems – An Industrial Case	May 2017
140	A hybrid model to schedule technicians in field services	Dec 2017
141	Heat input analysis while welding of S355NL	Dec 2017
142	Dynamic multi-technician scheduling in field service maintenance	May 2018
143	Investigation on corrosion rate while welding 0f S355NL by GMAW	May 2018
144	Modeling of vendor managed inventory system	Dec 2018
145	Design and development of an intelligent maintenance planning system	Dec 2018
146	Design and development of an intelligent process planning system	Dec 2018
147	Multi-objective field service maintenance workforce scheduling	Dec 2018
148	Towards industry 4.0: maturity model and gap analysis	Dec 2018
149	A frame work for design and development of an energy efficient system	Dec 2018
150	Multi-Technician scheduling in field services	May 2019
151	An intelligent process planning system for micromachining	May 2019
152	Analytical investigation on vendor managed inventory model	May 2019
153	Spare parts management using machine learning and a genetic algorithm	May 2019
154	Evaluation of Augmented reality industry 4.0 attainment gap analysis	May 2019
155	Sustainability measures for industrial heating systems	May2019
156	A frame work for sustainability measure in an automobile industry	Dec 2019
157	A framework for vendor managed inventory in supply chain	Dec 2019
158	A measure of readiness for industry 4.0	Dec 2019
159	Performance measures to improve lean production in automotive industry	Dec 2019
160	Implementation of E-maintenance practices in automotive industry	Dec 2019
161	Development of sustainability index for measuring the sustainability	June 2020
162	Barriers in Adoption of Vendor Managed Inventory in Automobile sector :	June 2020
163	Design of Self-assessment model to measure Industry 4.0 Readiness	June 2020
164	Productivity thru lean tools techniques in an automotive industry	June 2020
165	Development & implementation of intelligent e-practices	June 2020
166	A measure of sustainability for manufacturing process	Dec 2020
167	Application of Data Analytics in Aerospace and Aviation Sector	Dec 2020
168	Estimation of plastic waste using material flow analysis	Dec 2020
169	Selection of for sustainability in industrial system	May 2021
170	Company Bankruptcy Prediction using Machine Learning Techniques	May 2021

171	Crop Price Prediction Using Time Series Models	May 2021
172	Sustainability Measures In Industrial Manufacturing Processes	Dec 2021
173	Design And Development Of Prediction Model For Spark Plasma Sintering Using Multiple Regression Analysis And Artificial Neural Network	Dec 2021
174	Design and Development of Prediction Model for Laser Assisted Additive Manufacturing Using MRA and ANN	Dec 2021
175	Sustainability Measures in Additively Manufactured Products	May 2022
176	Fabrication Of AA7075 Matrix Surface Composites By Friction Stir Processing And Prediction Of Parameters Via Artificial Neural Networks	May 2022
177	Design And Stress Analysis Of An Aircraft Components Bracket	May 2022
178	Evaluation of sustainability measures in manufacturing industry	Dec 2022
179	Investigations on Corrosion Resistance of Nickel based Super Alloy fabricated using Wire and Arc Additive Manufacturing Process	Dec 2022
180	Framework for Auditing sustainability in Manufacturing Industries	May 2023
181	Estimation of Load increase factor for missing fasteners using finite element parametric analysis`	May 2023
182	Advancing Sustainability in Manufacturing:An Experimental Investigation into Micro Drilling of Magnesium Alloy Using TiAlN-Coated HSS Tools	Dec 2023
183	Sustainable Measures for Micro Turning	Dec 2023
184	A framework for sustainable manufacturing of nano composites	Dec 2023
185	Assessing optimum micro-drilling parameters and environmental impacts in micro-drilling operation of mg alloy using hss tool	May 2024
186	A comprehensive LCA of micro turning using sima pro software to establish sustainability	May 2024
187	A study on wear and corrosion resistance in aa7075 t6 aluminium alloy using nano-particle reinforcements and FSP	May2024
188	Effect of friction stir processing parameters on surface roughness and temperature in nano-composites	Dec 2024
189	Residual stress analysis of laser shock peened additively manufactured ss316l	Dec 2024
190	An evaluation model for establishing sustainability	Dec 2024
191	Study on investigation of metallurgical and corrosion behaviour of surface nano-composites fabricated by friction	May 2025
192	EBSD analysis of laser shock peened additively manufactured SS316L	May 2025
193	Measure of sustainability in an industry	May 2025
194	**Effect of mechanical behavior of additively manufactured AISI 316L ss material**	Dec 2025
195	**Effect of Heat Treatment and Laser Shock Peening on the Metallurgical Behaviour of Additively Manufactured AlSi10Mg Alloy**	Dec 2025
196	**E-MAINTENANCE USING ARTIFICIAL NEURAL NETWORKS**	Dec 2025
197	**Effect of Heat Treatment and Laser Shock Peening on the Mechanical and Tribological Behaviour of Additively Manufactured AlSi10Mg Alloy**	May 2026
198	**CORROSION BEHAVIOR OF ADDITIVELY MANUFACTURED AlSI10mg MATERIAL**	May 2026
199	**APPRECIATING AI TOOLS IN E-MAINTENANCE**	May2026

1. **Development of portable rotary MIG arc welding machine**: (Dec 1993) The rotary MIG ARG welding is one of the several techniques developed for narrow gap welding It has been found that fusion characteristics of the HAZ is improved because of the nature of the ARC physics . The process can be effectively used for different materials particularly those sensitive to heat input including high strength low alloy, stainless steel and heat resistant steels, aluminum and titanium alloys. Based on this result, it has been identified that this type of welding is more suitable for fillet and horizontal butt welding. The principle of the process is that the welding wire is fed into the electrode nozzle with eccentricity at the contact tip. The electrode nozzle is rotated at high speed by an eclectic motor, as a result the arc rotated at high speed. Hence in this project, a detailed design for converting the conventional MIG welding (ARC) machine into rotary MIG arc welding machine has been proposed. Along with this main modification the existing MIG welding machine – (a stationary downward ARG – HEAD which has provisions for horizontal and upward movements) is to be modified into portable welding machine.

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2. **Grid thickness variations control in nuclear steam generator:** The nuclear steam generator consists of tube sheet, shells, dished head and internal assemblies. The internal assembly consists of baffles, grids, and spacer tubes. The tube sheet is having 3660 holes through which 1830 U tubes are passing .The tube bundle is supported by the grids. The spacer tubes are used for locating the grids at definite intervals. The spacer tubes as specified cannot be used in grid assembly because of the variations in the grids. This calls for tailor made manufacture of spacer tubes at individual locations, which causes a considerable time delay in calculating individual spacer tube dimension. This project work details about the data calculation, analysis and recommendations for control of dimensions of the grid so that time delay can be reduced by standardization of spacer tubes.

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3. **Computer aided analysis of axisymmetric deep drawing process**: The deep drawing process involves forming of sheet metal into useful shapes like cup, cone, box or shell like part. The analysis of the deep drawing process includes the theoretical calculation of various stresses and strains based on the equilibrium of forces, the theories of plasticity, the strain relationship due to axial symmetry with some basic assumptions. This essentially requires some mathematical model to be formulated for the process and an effective solution methodology, which will be time consuming, when performed manually. Computers with their enormous data handling capacity and fast computing ability come in handy for this task. This project work details about the mathematical model formulation for the axi –symmetric deep drawing process with flat bottom punch. The project also details about the computer software development for the above task. The developed software will give the numerical results are useful for selecting / designing the equipment to do a particular job .This project computer aided analysis of the Axi – symmetric deep drawing process is realized as cost-time effective and reliable method

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4. **KBS for selection of material handling equipment**: In this project knowledge based system for selection of material handling equipment VP expert system is used. The system is flexible in selecting equipment for a combination of various factors. The system has been made user friendly to have an efficient interaction with the user byanswering the questions generated by the system as given in the programs in the knowledge base files. The system is designed as a tool kit for continuous improvement, extension and experimentation. In the knowledge base files programs were written by using rules, facts and relationships as required in this project work Syntax like. IF-THEN, ASK, CHOICES, DISPLAY etc. were used here with

reference to V.P. Expert system manual. In data base file information's regarding each equipment were stored by using D- base files package. Knowledge base files linked with one another by using CHAIN variable followed by knowledge base file name to be linked. Data –base file name was used in the MENU statements for linking a database file with the knowledge base file. In the correct combination of choices are found as given by the knowledge engineer in the program then the selected equipment will be displayed. if not , the user has to try for another combination of answered for various questions asked by the system.

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5. **Rule based expert system for equipment selection**: In the present industrial scenario the machines available to do an operation is in plenty. Each machine has its own merits and demerits .For an entrepreneur who wants to install machines for manufacturing; the selection of equipment in the most economical way is very essential. Therefore, an individual cannot do the cost optimization process with the large amount of data for the machines available in the market. This analysis could be done by an expert in this field with some 25 years' experience. If one could do an expert system for this, it would be an advantage to the new entrepreneur. This project report has been designed in the following way. The first chapter gives you an introduction to decision support system, Artificial intelligence in the decision support system. The second chapter gives you an introduction to the expert system with more references to develop an expert system. The third chapter deals with the problem which I have taken for this project work. It also tells about the problem solving approach. The fourth chapter deals with the expert system design. The fifth chapter deals with the working procedure of the system. There are three annexure. The first one gives a model input and output. The second one has the expert system program. The third one has the data base structure. The fourth one has the block diagram of expert system and the allocation diagram of the modules

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6. **A knowledge-based system for machine layout**: The objective of computer aided layout programs is developing a block area layout of facilities that minimizes the cost of interaction among the blocks (departments). In manufacturing layouts, the interaction to be minimized is usually material handling cost. Two major classifications of computer programs for facilities layout exits, the construction type and the improvement type. While there are 22 separate Construction programs, the mostly widely known are CORELAP, ALDEP. And COFAD are most widely known. The knowledge based system for machine layout is of construction type and its objective is to minimize the material handling cost. Given the number of machines, flow matrix, cost matrix, floor space, clearances, dimensions of machines, the system will place the machines as given below. Starts from left top most of floor spanThe machines are placed from left to right lengthwise. If machines are not possible to be accommodated in a single row, the system wills the remaining in the next row starting from right. This process is continued until all the machines are placed. The sequence is obtained by using spanning tree algorithm. Suitable suggestions are given whenever

problem arises due to wrong data entry. Suitable material handling carrier is suggested according to the layout. The first chapter introduces expert system. The expert system structure, knowledge representation, knowledge acquisition etc., are dealt well. The second chapter deals with the general approach to lay out planning and its concepts. The third chapter deals with knowledge based systems structure for machine layout. In the fourth chapter, the problem solving approach is given .the fifth chapter deals with the spanning tree algorithm for sequencing layout. The sixth chapter deals with selection of machines and material handling equipments. The computer program has been given in the seventh chapter. The programming was done using C and C- Graphics. The results conclusion and bibliography are given at the end of this project.

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7. **Automatic design and drafting of deep drawing dies**: Today, the use of computers in the manufacturing industries has been an emerging trend in the world. One such application is designing and drafting of manufacturing tools like dies and punch. Computer Aided Drafting (CADD) is the latest tool used for engineering Graphics. The development of software, improvements in hardware technology and lower costs have led to widespread adoption of CADD systems in industry. The project report presents the design and drafting of deep drawing dies with help of computers. With the given cup dimensions , material specification , minimum percentage of elongation , the height and diameter of intermediate cups have to be calculated and also has to specify the intermediate draws , punch and die dimensions . After each draw the diameter of cup obtained will be compared with the diameter of required by the user in the case of cylindrical shells. When the diameters are equal the process comes to an end. The each and every values of die and punch calculated as above will be stored in separate files for each draw and with help of AUTOCAD, the output in the form of drawings is obtained. The calculation steps are programmed through C Language which Features economy of expression, modern control flow and data structures

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8. **Optimization of cellular manufacturing system using GA**: Cellular manufacturing system is the group technology based manufacturing system, in which parts similar in design and/or manufacturing are grouped together in one part family. For each part family, a set of machines called as machine cell is grouped so that majority of the processing needs of corresponding part family are completed there. A brief introduction about group technology is given in the first chapter. The methods of classification of parts into part families and machines into machine cells are dealt in this chapter. In addition to that, the advantages of group technology over conventional process type layout is also included in this chapter. The second chapter gives a brief insight into the literature review that has been carried out for this project. The philosophy of Group Technology is explained in the third chapter. The various ways of classifying the parts into part families and the machines into machine cells is briefly explained. The fourth chapter deals with the cellular manufacturing system, its background, factors affecting the performance of a cellular manufacturing system, difficulties that are arising in implementing a cellular manufacturing system and the need for optimizing a cellular manufacturing system. The fifth chapter gives a brief insight about the traditional and non traditional Optimisation techniques, problem formulation and the advantages of a nontraditional Optimization technique overtraditional techniques. The sixth chapter deals with the problems that are addressed in this project while designing a cellular manufacturing system and how they are modeled. The seventh chapter gives a brief introduction about genetic algorithm, difference between GA and traditional Optimization techniques. The important operators of GA are described in this chapter. The eighth chapter deals with the application of GA in solving a machine cell formation problem. Various terminology's of GA are defined in this chapter. In

addition to that a number of GA design issues such as representation, initialization, fitness function, reproduction, crossover and mutation are discussed. The ninth chapter deals with the computational results and discussions. The programming is done using Turbo C. Three problems, which have been taken from published literature are solved using this program and the results are presented ion the form of tables. The tenth chapter shows the effectiveness of genetic algorithm in solving machine cell formation problem by comparing the genetic algorithm solution for the above said problems with that obtained from a traditional Optimization technique. The eleventh chapter gives the conclusion for this research. It also gives the scope for further research to be carried by in cellular manufacturing system.

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9. **Object oriented design and prototyping of Cellular Manufacturing**: The present project work entitled "Object Oriented Design and prototyping of Cellular Manufacturing Systems " appreciates the application of Object Oriented Concepts in modeling and design of the CMS. Four phases were identified in the design of the CMS, which are :Cell formation Problem (CFP) Cell Layout Problem
Shop Layout Problem Cell sheduling Problem.

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10. **Prediction of Machining Quality Using Taguchi and ANN**: Computer Numerical Controlled machine tools provide greater improvements in productivity and increase the quality of the machined part. Among several CNC industrial- machining processes, milling is a fundamental machining operation. The quality of the surface plays a very important role in the performance of milling. The good quality milled surface improves fatigue strength, corrosion resistance. Several factors like spindle speed, feed rate and depth of cut will influence the final surface roughness of milled components. There is a need for developing technique to optimize the parameters and predict the surface roughness of a milled product under given machining conditions. The project proposes the use of Taguchi Technique for optimizing the process parameters and the development of Artificial Neural Network for prediction of the product surface quality. Taguchi technique is used to design and analysis of the experiment so as to optimize the cutting parameters. The independent factors are spindle speed, feed rate and depth of cut while the dependent factor is product surface roughness. The planned experiments are conducted for the proposed CNC machine tool and the signal to noise ratio is computed to decide the optimum parameters. The responses of the factors are also validated using ANOVA analysis. Multiple regression analysis is carried out considering the conclusions, data arrived from Taguchi's experimentation, and the specific equation is derived. The Neural Network is modeled to capture the generalization of the process inputs and outputs. Using the multiple regression equation, the data for training the network are generated. On completion of training, the neural network is forwarded as Predicting network to predict the surface roughness for any given machining conditions.

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11. **Managing New Product Development**: In recent years simulation techniques are gaining popularity among business management tools. The distinct advantage that simulation techniques offer is to experience the process with out actually performing it. Further it offers flexibility of controlling several variables in contrast to the conventional techniques in which only one or two variables were considered. The objective of this project was to develop methods of managing new product development so as to reduce the cycle time a significant contributor to the success of business. New product development is the process of translating new ideas into product. It is complex and uncertain. Existing methods are limited in real time data handling and fast analysis. The project work proposes the use of discrete event simulation packages in managing the new product development. A case study is considered from an engineering

industry. Its R/D wing had to deal with product development on a continuous basis. The wing was using traditional estimation methods in deciding project completion time. The New Product development is modeled as project and traditional computation was carried out using Microsoft Excel. The project completion time and the probability to complete the project are estimated. The development process was modeled with the help of Sim process & Arena. The major factors Time and Cost, which is the base for any project, were mostly taken in to account, to develop an optimum project plan.Using these packages not only a project plan was developed, but the identification of bottlenecks, maximum activity usage, answering what if questions and analysis of results after a number of runs were done easily. The simulation of these project is very helpful to decision making the time taken to complete the process defines the cycle time for the project .The influence of the every individual elements on the project due date were found Simulation of project network with random selection of activity duration with its appropriate probability distribution will make the simulation close to reality.

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12. **Fuzzy Expert System for Tool Selection**: Automation has been associated with advancement in technology. Mass production process plants throughout the world owe their success to the development in engineering industries. This has been achieved through tooled up general purpose machine tools automatic unit built machine tools, automatic transfer machine, CNC machines and so on. At this point regardless of machine power rigidity and accuracy, a tool selection becomes necessary. Appropriate tools reduce the expensive downtime of a machine of sizable capital investment. The improved cutting tools have helped reduce many manufacturing costs, economy stops, for the most part, as soon as a tool starts to wear. The selection of cutting tools in turning center is very crucial as uncertainty and vagueness in machining conditions. The expert systems are in use for selection of cutting tools but do not cope with uncertain environments of rapid machining technology. The fuzzy logic rapidly has become one of the most successful of today's technologies for developing sophisticated control system, which handles vagueness and uncertainty. This project proposes the use of use of fuzzy logic expert system to represent uncertain machine conditions to use with knowledge base of cutting tools to select cutting tools. The following methodology is used in developing the proposed fuzzy expert system for cutting tool selection 1) Defining Fuzzy Sets 2) Relating Observations to Fuzzy Sets 3) Defining Fuzzy Rules 4) Evaluating each case for allFuzzy Rules 5) Combining Information from Rules 6) Defuzzy results. The following fuzzy expert systems are developed and validated using MATLAB fuzzy toolbox. a) Fuzzy Expert System for Tool Selection in Turning (FESTS-T). b) Fuzzy Expert System for Tool Selection in Milling (FESTS-M).

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13. **Control Chart Interpretation using ANN**: This work has been done to enable a major Wheel and Axle manufacturer to determine the process out of control situations and take corrective action prior to the onset of problems in product quality and in real-time situations using Artificial Neural Networks. The work formulates Shewart mean (x-bar) and range (R) or standard deviation (S) chart for diagnosis and interpretation by Artificial Neural Networks. Two back propagation Neural Networks are used to model traditional Shewart SPC charts for identifying out of control situations as specified by western electric rules and to recognize samples of instability. The network will be trained to identify situations that violate any of the four tests for unnaturalness; and identify what pattern the data is exhibiting to better understand the underlying distribution. And another back propagation network is modeled and trained to predict future subgroup means based on immediate past subgroup means. The forecasting of future control points assists in shapes identification in borderline

situations. The implication of this work is that out of control situations can be detected automatically and corrected within a closed loop environment. It is an automated process monitoring and control system based on control chart methods. The results indicate that the performance of the backpropagation neural network is accurate in identifying control chart patterns and prediction of future subgroup means. The entire work in network training, testing and simulation is carried out using NNtoolbox of MATLAB 6.

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14. **Fixture Layout Optimization using GA and FEM**: Fixtures are used to locate and constrain a workpiece during a machining operation. To ensure that the workpiece is manufactured according to specified dimensions and tolerances it must be appropriately located and clamped. Fixture layout is the procedure to establish the workpiece fixture contact positioning the clamps and locators such that the workpiece location errors due to localized elastic deformation is minimized. Deformation of the workpiece may cause disastrous dimensional problems in practice, particularly, when flexible sheet metal is used. Dimensional and form accuracy of a workpiece are influenced by the fixture layout selected for the operation. Optimization of fixture layout is a critical aspect of machining fixture design. The optimal fixture design is focused on determining the positions of locators and clamps to minimize workpiece deformation. . Most of the work on fixture design either has ignored deformation of the workpiece or has been limited to workpiece deformation analysis. Moreover the current practice for minimizing the error is based on experience and non-linear optimization method using rigid body modeling of the workpiece, which has drawback of non-optimal solutions due to miscalculations and rigid body models. This project work presents a fixture layout optimization technique a hybrid of genetic algorithm (GA) and finite element method. To validate the results an algorithm is developed using ANSYS Parametric Design Language (APDL) to optimize fixture support and clamp location, and clamping forces, so as to minimize workpiece deformation. A fixture workpiece system of 2-Dimensional plate 305*254 mm ismodeled and tested on the proposed algorithms. The proposed method is faster and accurate in results.

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15. **Virtual manufacturing** A production centered Approach using Quest: Virtual manufacturing is a recent technique and it is an integrated synthetic manufacturing environment, exercised to enhance all levels of decision and control. The vision of Virtual Manufacturing is to maximize communication by defining the product, process & resources within cost, weight, investment, timing and quality constraints in the context of the plant in a collaborative environment that integrates the engineering & business information system. It has direct impact on productivity of designers and improves manufacturing design responsiveness, team communication & understanding. One among the Virtual manufacturing paradigm is the Production Centered Virtual Manufacturing which uses its capability to simulate manufacturing process models with the purpose of allowing inexpensive, fast evaluation of many processing alternatives. It is the production-based approach towards the optimization of manufacturing process, potentially down to the physical level. It also adds analytical production simulation to other integration and analysis technologies to allow high confidence validation of new process & paradigms. The discrete event simulation tool named ‘QUEST’ is used to realize the above objective. The manufacturing problems of unique nature are modeled representing the physical manufacturing facilities as two-dimensional or three-dimensional graphics, without spending any effort or money and validated. The unique characteristics of the manufacturing systems under evaluation are assigned correctly and easily by using SCL (simulation control language) and BCL (batch control language) of QUEST. Thus Manufacturing systems are virtually designed, analyzed and statistical evidence supporting decision-making is obtained in the form of graphs, histograms, bar charts,

and pie charts. Through experimental analysis optimal levels of process variables that maximize the system performance are identified. Resource schedule for labor, material handling and processing equipment are derived. The impact of changing production schedules and strategies are studied and reported.

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16. **Function Replacing Hybrid for Intelligent Manufacturing**: Metal forming and machining are important manufacturing processes with wide product groups being shaped through them. Automatic selection of tools and accessories in these processes heavily relies on forming force/ cutting force estimation. Complex relationships exist between process parameters and these forces. Intelligent Manufacturing Systems are outlined as the next generation manufacturing systems, utilizing the influence of artificial intelligence research. Intelligent tools like Artificial Neural Networks and Genetic Algorithms are in extensive use to cater the various requirements of intelligent manufacturing. The varieties of Neural Networks are being tried for capturing the characteristics of the manufacturing process and used to predict, classify, recognize the effect of the process parameters. Multi-Layer neural networks trained with backpropagation algorithm are one among them. A gradient descent algorithm is used to adapt the weights but it ends in local minimum or near optimal.. This project describes a function replacing hybrid approach (PNNGA) to substitute the training function by a genetic algorithm. The software is developed using MATLAB toolbox routines. Finding the optimal weights using GA makes the model efficient and accurate. The networks are modeled and trained using the new approach.The trained network is used for manufacturing process predictions. The results obtained from PNNGA are competent and computationally efficient than traditional method. This work has considerable implications in selection of the tools and on-line monitoring of tool wear.

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17. **Computer Aided Factory Integrated Management Systems A Case Study**: Information System (IS) has become an integral component of any modern business, especially, in the executive decision making level. Without the timely and accurate information, even the best executive will be severely hampered when studying high-level considerations. To develop most suitable and effective information systems, time and money are invested. This project work delivers a step up step process for developing and installing an information system tailored to the specific needs of an industry under study. For developing the IS, system approach is applied starting with Sales Order processing objectives and working down to specific activities and identifying the related information. Information requirements are identified by studying the existing system like support operations, management and decision- making functions. The documentation is then processed in the different modules of Computer Aided Factory Integrated Management Systems (CAFIMS) an ERP computer package. The IS developed can provide an accurate, up-to-date information in an effective and timely manner for decision-making process and to turn the needs in to reality. There is an excellent scope to expand the developed IS for the entire organization.

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18. **Computer Aided Maintenance Planning system**: Maintenance of machines is necessary to bring down time to minimum and a good system is essential to achieve effectiveness and efficiency in maintenance. The maintenance department is one of the greatest levers of profitability that any capital-intensive organization has. Maintenance can add value to the finished goods of a plant and that it can contribute to reliable production capacity. Many companies have been practicing manual systems in the past. The paperwork for maintenance record keeping activities consumes considerable time for maintenance personnel which add up heavy financial loss and loss in maintenance productivity for a company. Considering the above facts,

the software project was developed for maintenance planning, which helps the maintenance personnel to plan maintenance activities effectively and improve decision-making. The proposed software was developed using Visual Basic as front end and MS ACCESS as back end. The modules covered in this project are service request, machine details, work order, preventive maintenance scheduling, spares inventory planning, breakdown maintenance and equipment history card. The machine detail module retrieves the details regarding the machine whenever necessary. The work order module is developed to indicate information regarding the work status, maintenance work scheduling, manpower assignment, rescheduling, spares and labor cost. The breakdown reports which are generated from work order module are failure analysis and pending breakdown machine reports. PM scheduling module covers PM schedule programs, planned work schedule for particular time and Checklist gives the task list for particular machine for mechanical and electrical tasks. The PM scheduling module plans complete preventive maintenance activities carried for the particular machine. The spares planning module the system helps in storingand retrieving part details, parts status, spares availability and inventory monitoring. The proposed software is validated with case studies.

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19. **Supply Chain Modeling**: Supply chain is a network of suppliers, manufacturers, distributors and retailers who are collectively concerned with the conversion of raw materials into goods that can be delivered to the customer. It is a dynamic, stochastic and complex system. The objective of the supply chain is to enhance the operational efficiency, profitability and competitive position of a firm and its supply chain partners. Supply chain stages include procurement, production, inventory and distribution. Supply chain analysis can be performed at different stages. Production distribution planning is one of the most important activities in supply chain management. The main decisions involved are plant location, capacity allocation and market (demand) allocation. These decisions influence both cost and customer experience. Since customer demand is not a static factor in real world situation, capacity allocation for plants under fluctuated customer demand is an area that requires much attention. In this thesis a combined simulation analytic approach is used to allocate the capacity and obtain minimum cost distribution plan under fluctuated customer demand. The model problem consists of two plants, two warehouses and three customers. Considering the demand as a deterministic factor the analytical model is built and solved using Microsoft Excel's solver. The financial performance is obtained. Later the variability was introduced by considering the monthly demand of three customers is normally distributed with the same mean as deterministic value with the standard deviation of 10%, 15% and 20% for customer 1, customer 2 and customer 3 respectively. The financial performance is obtained for each replication. By considering Total Margin for fluctuated demand, the capacity is suitably adjusted. An inventory-planning model detailing the approaches to find out best inventory policy under fluctuated customer demand is also elaborated.

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20. **Design optimization using FEA and Function replacing hybrid**: Welding is a reliable and efficient metal-joining process widely used in industry. In the design of a dynamically loaded welded structure many uncertainties are to be addressed. Besides the external loads, the real geometry constraints and internal loads such as residual stresses has to be considered to optimize a welded structure design. Welding induced tensile residual stresses increase the mean stress and therefore decrease the maximum possible stress amplitude and life time respectively. Residual stresses due to welding are important criteria for an optimal design of a welded structure. In this work an approach is shown to calculate the welding induced residual stresses due to heat input during the welding process by means of finite element analysis. A finite element (FE) simulation of the welding process yielding the welding-induced residual stresses in a butt-welded

plate using ANSYS is presented. Finite Element Analysis is not feasible for all variable designs and hence a neural network model is proposed to predict the welding residual stress for any given welding parameters. The developed neural network is embedded with Genetic algorithm for network weight updation to reduce the training time. The Proposed Neural Network is validated.

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21. **A heuristic for multi project scheduling**: Business trends today require front-line managers to integrate multi-project concepts with those of traditional single projecmanagement since very rarely can one find major organizations managing just one project. A typical situation entails a limited pool of resources that is applied to the management of several projects, with people moving back and forth among different assignments in different projects. Yet, few studies on project management have started to explore the issue of how to manage an organization with multiple inter- or intradepartmental projects. anaging multiple projects, also known as portfolio or program management, is as much an art as a science. It is more complex, more time-consuming and ultimately riskier than managing an individual project. Planning and controlling several projects simultaneously means more than simply dealing with multiple schedules. It involves the integration of resources, schedules, budgets and stakeholder needs. It is clearly known that additional skills and even changed attitudes are needed to succeed in this high-stakes environment. One method of managing multi-projects is to consider each as a sub project. Its scheduling is significant if the resources are shared between projects. Multi-project scheduling and resource allocation needs a better system, which will be evaluated with parameters like schedule slippage, resource utilization and in-process inventory. A number of optimization techniques have developed for the single project scheduling problems. However these techniques are successful in solving only small problems. Thus, efforts have turned towards heuristic procedures and scheduling rules aimed at the development of good solutions. The work done in this project is development of a heuristic to schedule multi-projects with limited resources. In this heuristic critical path method, which is a project management technique is used for identifying critical activities, non-critical activities and for calculating maximum duration of projects. A set of priority dispatching rules also included in this heuristic to schedule based on the arrival, importance and due date of projects.

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22. **Multi objective task scheduling of AGV using GA**: The increased use of Flexible manufacturing system to meet customer's demand with diversified products has created a significant set of operational challenges. Although extensive research has been conducted to design and operational problems of automated manufacturing systems, many of the problems still remain unsolved. In particular after the implementation of the flexible manufacturing system, the scheduling of the resources becomes a difficult task. The FMS scheduling problem has been previously tackled by various optimization techniques like mathematical programming techniques. Because of the shortcomings of those techniques, random search algorithms are used for scheduling Flexible Manufacturing Systems. In this project a Genetic Algorithm based scheduling mechanism is proposed and designed to generate a near optimum schedule with multiple objectives. The proposed method is validated with case studies.

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23. **Product Development using DSM and A heuristic**: Product Development is an important and complex business process of transforming new ideas into marketable new products, processes or services. It constitutes a major contribution to the business excellence of any industry. As Product development projects have become more and more competitive and globalized, scheduling and managing large projects has become

a difficult task that needs much effort and experience. The current project scheduling tools are weak in the areas, such as sequencing, controlling and managing the product development projects. In this project work, a heuristic is proposed for scheduling andrescheduling the product development projects based on DSM (Design Structure Matrix) as a remedy for the weakness mentioned above. The product development projects are delayed either due to the delay in particular task or due to the iterations i.e., repetition of a group of tasks. Initially, a DSM is generated using a Problem Solving Matrix (PSM32) program based on the information such as, number of tasks, duration of each task and dependency relationship among the tasks. The obtained DSM is then manipulated to give the different groups of tasks that iterate due to the dependency relationship among them. Based on this information, the duration of the project is determined by the proposed heuristic through Critical Path Method and the tasks that are involved in the project are scheduled. Then, depending up on the type of delay i.e., task delay or iteration delay, the project is rescheduled, so that it is finished within the stipulated duration. A case study is provided to illustrate the proposed heuristic.

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24. **Multi project Scheduling using heuristic and GA**: Managing multiple projects is as much an art as a science. It is more complex, more time-consuming and ultimately riskier than managing an individual project. Planning and controlling several projects simultaneously means more than simply dealing with multiple schedules. It involves the integration of resources, schedules, budgets and stakeholder needs. Project scheduling has been studied by a number of researchers in recent years. However, the existing researchers have been limited to the study of single project scheduling. The tools and techniques to schedule multiple projects with multi-resource constraints are limited and are successful in solving only small problems. Thus, efforts have been turned towards non-traditional techniques aimed at the development of good solutions. Heuristics for addressing multi-project scheduling with resource constraints are not consistent. In this work a genetic algorithm approach has been used to obtain an optimal solution for multi-project scheduling. The activities of all the projects have to be scheduled subjected to precedence and resource constraints. The objective is to minimize the make span of the projects. The proposed genetic algorithm is validated with numerical examples and is found optimal.

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25. **AGV task scheduling using Non traditional optimization**: The increased use of Flexible manufacturing system to meet customer's demand with diversified products has created a significant set of operational challenges. Although extensive research has been conducted to design and operational problems of automated manufacturing systems, many of the problems still remain unsolved. In particular after the implementation of the flexible manufacturing system, the scheduling of the resources becomes a difficult task. The FMS scheduling problem has been previously tackled by various optimization techniques like mathematical programming techniques. Because of the shortcomings of those techniques, random search algorithms and construction algorithms are used for scheduling the resources in a Flexible Manufacturing System. In this project Genetic Algorithm and Ant Colony Optimization technique are used for scheduling the tasks in a flexible manufacturing system by generating a nearer optimum schedule with multiple objectives. The proposed methods are validated and are compared along with case studies

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26. **Machining Quality prediction using function replacing hybrids**: There is always a contention between increasing the production rate with quality and decreasing the cost, time to manufacture of a product. Attempts like automation, CIM and intelligent manufacturing system are made with the above goal. There is need to develop a robust, autonomous & accurate monitoring system. In machining process, surface finish is a key factor in evaluating and determining the quality of a part. In practice, a desired surface roughness value is usually designated and the appropriate cutting parameters are selected

to achieve the desired quality of a specified part. The machining theory based approach and experimental investigation approach considering vibration factor for prediction of surface roughness has its own limitations. Although a qualitative analysis of machining variables of speed, feed and depth of cut on the surface roughness has been widely available in the literature, very few comprehensive predictive models have been developed considering vibration factor. This project aims to develop an efficient technique to predict the machining quality incorporating the vibration signal. Experiments are designed and its results are used to develop a multiple regression model. Neural networks with Genetic algorithm for weight updation and Adaptive Neuro Fuzzy Inference System (ANFIS) is built as a Function Replacing Hybrid to predict the machining quality and finally its prediction capabilities are evaluated. The proposed function replacing hybrid ANFIS has good agreement with the experimental results scopes as a better monitoring system.

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27. **Delinquency stage Prediction a comparison**: In any financial services concern, the collection of the amount financed to the customer, within the predetermined time, directly impacts the profits of that concern. Due to the increasing competition, these concerns are going even to the risky and high risky customers. Once the concern goes for a risky customer, it has to enhance its capabilities towards the collection of the financed amount, in time without resulting in any loss to the concern. At the same time, there exists a huge customer base but only limited collectors. In such a scenario, there is an absolute need to predict the behavior of the accounts in future, so that the collectors can follow different strategies for high, low and medium risk customers. In a move towards this, two models are proposed in this project, namely, Markov Processes Model and Logistic Regression Model. They model the behavior of the accounts in the past by considering several factors that may directly or indirectly influence their behavior in the future. They come out with the probability of the accounts to go form one delinquency state to another one. The two models are validated with a numerical example and the results were found to be satisfactory. The two models are compared to come out with the best one and the same is suggested to the business for its real time application.

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28. **Assembly Task Scheduling using GA**: Customer demand now requires more flexible automated manufacturing systems. Assembly sequence affects manufacturing equipment layout and manufacturing process selection. Given feasible assembly sequences, one can determine optimal machine selection and equipment layout for each sequence. Hence generating sequences of assembly is a vital in the design/ manufacturing chain. In this work, an genetic algorithm is developed to generate and evaluate an optimum or near-optimal assembly plans for a given product. An appropriate scheduling mechanism between assembly tasks with the objective,minimization of make span, is presented using Genetic Algorithm. To meet this objective, the model takes into account the assembly times along with the resources for each task. Each assembly plan is encoded into a chromosome, to be manipulated by genetic operators. An evaluation function and a selection procedure, purposely developed crossover and mutation operators, retain the best plans that expand the population and serve for new generations. The results of the proposed genetic algorithm are validated using a case study.

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29. **FEA in Precision Engineering:** This report is prepared to appreciate the application of finite element analysis in precision engineering. Precision engineering is the forefront of the current technology, which need extensive application of Finite Element Analysis for designing precision machines. In this report why FEA is important and how it is applied for design process are given with some examples. The use of FEA and

how it is merged with manufacturing industry (to perform process simulation, prediction of failures, design analysis of product and process, structural analysis, material optimization) are also discussed. This report provides the basic concepts of precision engineering and tools necessary for the engineer for precision engineering design. The literature review in this report provide the past work carried out in the precision engineering design, also how the Finite Element software is used for designing the precision engineering processes and equipments. The past works show the broad use of FEA in precision engineering. The scope for FEA in Precision Engineering is more in potential. Two case studies demonstrate the principles and showcase approaches and solutions to specific problems that generally have wider applications

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30. **FEA in Pressure parts**: Pressure vessels are a commonly used device in power plant engineering. Until recently the primary analysis method had been hand calculations and empirical curves. New computer advances have made finite element analysis (FEA) a practical tool in the study of pressure vessels, especially in determining stresses in local areas such as penetrations, O-ring grooves and other areas difficult to analyze by hand. This project set out to explore applicable methods using finite element analysis in pressure vessel analysis. Problems such as local stress risers, unrealistic displacements and understanding how to use such data become extremely important in this kind of analysis. This highlights the key to proper use of finite element analysis.

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31. **FEA in Tool Engineering:** This project reports on the literature review of the use of FEA in tool engineering. Tool engineering deals with the tooling i.e. all the supporting devices that are used to carry out the manufacturing processes. It includes design and analysis of jigs and fixtures, press tools, plastic moulds and dies, design of measuring equipments, gauges, cutting tools, dies for castings, forging, extrusion, machining tool analysis etc. In this paper ANSYS is used for analysis. The use of FEA and how it is merged with manufacturing industry are also discussed. A literature review was done, by referring lot of journals with the topic FEA in Tool Engineering and they are listed below. Among the literature survey some case studies were taken and they are listed below. Among the literature survey some case studies were taken and they are worked with ANSYS and the results are given. Future work will focus on modeling the cutting processes and study the different parameters associated with these process, also conduct the same process experimentally and compare both the results.

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32. **Optimization of Supply Chain logistics**: Fierce competition in the markets is making the companies move from their traditional business strategies towards integrated strategic alliances. In order to integrate and manage their business process like procurement, inventory, manufacturing, logistics and sales, a new technological and quantitative tool is needed. A well performed study of such supply chain is of vital importance and needs attention. A typical supply chain logistics system aims at a network strategy that fulfills the customer demand along with the minimum cost of physical distribution. In this paper a genetic algorithm and particle swarm techniques are proposed and validated for optimizing supply chain logistics network.

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33. **Modeling and simulation of projects using Petri nets**: Efficient project management requires more than good planning, it requires that relevant information be obtained, analyzed, and reviewed in a timely manner. This can provide early warning

of pending problems and impact assessments on other activities, which can lead to alternate plans and management actions. . They form the basis for all planning and predicting and help management decide how to use its resources to achieve time and cost goals. Management is continually seeking new and better control techniques to cope with the complexities, masses of data, and tight deadlines that are characteristic of highly competitive industries. Managers also want better methods for presenting technical and cost data to customers. These techniques help management to evaluate alternatives by answering such questions as how time delays will influence project completion, where slack exists between elements, and what elements are crucial to meet the completion date. Traditional project management tools and other revised tools are limited in representation of the problem and in dealing situation dynamically. This project details the use of Petri nets as a graphical and mathematical modeling and simulation tool in project management. In this context, the benefits of Petri nets are indicated. Petri net aided software, a PETRI-PM is developed to model, simulate and analyze the project. Extensions to make Petri nets suitable for project management applications are proposed. The use of a PPC-matrix for token movements is proposed. The project also discusses the implications of the model and the analysis it supports. The usefulness of the software is exemplified with a case study.

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34. **Energy management in compressors using artificial intelligent techniques**: The demand for energy is growing and energy management has become vital from the smallest concern to the largest multinationals. The methods and techniques adopted to improve energy utilization will vary depending on circumstances, but the basic principles of reducing energy costs relative to productivity will be same. Energy management requires huge manual work, time and support of knowledge experts. Moreover energy experts are scarce and costly to hire Application of a self decision making energy management device will be faster, cost effective and efficient. Factors involved in energy management are vague and uncertain. Hence there is a need for more accurate quicker techniques that can think like humans do. Neural network and fuzzy logic rapidly has become one of the most successful of today's technologies for building sophisticated control system, which handles vagueness and uncertainty. This project proposes the use of neural network and fuzzy logic expert system to perform energy management in an air compressor. The neural network is trained for optimum output a compressor should give for standard conditions. Hence when an aberration happens it calculates the deviation of the aberration and sends it to the fuzzy inference systems which fuzzifies the input and gives optimum values of process variables in order to reduce the aberration. Once the optimum conditions are calculated by neural network and fuzzy logic, they are sent to suitable controllers. Hence the compressor parameters are controlled to optimum level. The energy conserved for a specific period of time is simulated using simulink. This expert system is developed and validated using MATLAB Neural Network and Fuzzy Logic tool boxes. Neural network and fuzzy logic were interlinked with well defined user interface using simu link.

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35. **Submerged arc welding quality prediction using GA and ANN**: Submerged arc welding (SAW) is one of the chief metal-joining processes employed in industry for the various applications because of its high quality and reliability. Its inherent advantages, including deep penetration and a smooth bead the quality of the welded material can be evaluated by many characteristics, such as bead geometric parameters (penetration, width and height) and deposition efficiency. These characteristics are controlled by a number of welding parameters (welding current, voltage, welding speed) and, therefore, to attain good quality, are important to set up the proper welding process parameters. Engineers often face the problem of selecting appropriate and optimum combinations of input process control variables for achieving the required weldments. In order to get high weld quality, it is very important to select the optimum

combination of input process variables. To solve the stated problem above, experimental optimization is possible, but it is very costly and time-consuming task. In this project work artificial neural networks (ANN), genetic algorithm (GA) are used for the determination of welding initial process parameters. The data set for the process parameters and weld parameters are obtained from experiments. This data set is used to train the neural network. The trained neural network system can provide a set of welding parameters quickly according to the results of the predicted quality measures. GA has been adopted to optimize the process parameters for maximum penetration and minimum bead width even without the knowledge of process relationship and from this approaches, it was found that the time required for determining the initial process parameters are greatly reduced.

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36. **Product and Process Design in Welding Using FEA** Submerged arc welding (SAW) is one of the chief metal-joining processes employed in industry for the various applications because of its high quality and reliability. The quality of the welded material can be evaluated by many characteristics, such as Heat affected zone, bead geometric parameters (penetration, width and height) and deposition efficiency. These characteristics are controlled by a number of welding parameters (welding current, voltage, welding speed) and therefore, to attain good quality, are important to set up the proper welding process parameters. Engineers often face the problem of selecting appropriate and optimum combinations of input process control variables for achieving the required weld quality. In order to get high weld quality, it is very important to select the optimum combination of input process variables.

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37. **Optimization of process parameters in submerged arc welding using Taguchi method:** Welding is a process for joining different materials. It is more economical and is a much faster process as compared to both casting and riveting. Because of high quality and reliability, submerged arc welding is one of the chief metal joining processes employed in industry. With the proper selection of equipment, SAW can be applied to a wide range of industrial applications. The high quality of welds, the high deposition rates, the deep penetration and the adaptability to automatic operation make the process particularly suitable for fabrication of large elements. The quality of SAW is mainly influenced by independent variables such as welding current, voltage, speed and electrode sickout. The aim of the project is to optimize the individual welding parameters and predict the bead geometry for the given welding conditions. The Taguchi technique is used in design and analysis of the experiment and to optimize the weld parameters. The planned experiments are conducted in the semi-automatic SAW machine and the signal to noise ratio's are calculated to determine the optimum parameters. The percentage contribution of factors is validated by ANOVA technique. The outcome of the experimentation is used to develop a specific equation using multiple regression analysis. The Artificial Neural Network for predicting the bead geometries like bead width, reinforcement, penetration and also hardness is developed with the training data generated with the equation developed. On completion of training, the neural work is forwarded as predicting network to predict the bead geometry for any given welding conditions. solve the stated problem above, experimental optimization is possible but it is very costly and time-consuming task. In this project work finite element analysis (FEA) and artificial neural networks (ANN), are used for the determination of welding initial process parameters. The data set for the process parameters and weld quality parameters are obtained from finite element analysis experiments. This data set is used to train the neural network. The trained neural network system can provide a set of weld Heat Affected Zone parameters quickly according to the input process parameters. It was found that the time required for determining the initial process parameters are greatly reduced.

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38. **Optimization of Supply Chain Logistic Network Using GA AND PSO** Supply chain is now at the centre stage of the business performance of manufacturing and service enterprises. Because of the inherent complexity involved in the decision making in supply chain, there is growing need for modelling methodologies that can help identify and innovate strategies for designing high performance supply chain networks. A large number of manufacturing and service organizations are therefore seeking modeling systems that can help identify and implement strategies for designing and improving their supply chain networks. This work highlights the different issues of supply chain management. In addition, the supply chain decisions are classified based on the time horizon. It provides the overview of the tools and techniques for available for supply chain decision-making. Relevant literatures are reviewed. In this work a linear programming model for a supply chain logistics network is formulated and genetic algorithm is used a tool for solving the supply chain logistic network problem. Also a mixed integer programming model is formulated for production-distribution planning problem in a supply chain and particle swarm optimization technique is proposed as a tool for solving the above problem. A numerical example is solved for both supply chain logistic network problem and integrated production – distribution-planning problem and the results are validated using Excel's solver.]

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39. **Modeling and Simulation of Projects using PN**: Classical bureaucratic organization structures are changing to lean, mean and flat structures. The project management techniques become essential decision making aid. Traditional project management tools and other revised tools are limited in representation of the projects and constrained in real time application. Petri Nets are extensively used in many fields and become a popular modeling and simulation tool. This paper proposes the use of Petri Nets in modeling, simulation and analysis of Projects. Extensions to make Petri nets suitable for project analysis are detailed and the software development is explained. The use of software is exemplified with case study.

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40. **Energy management in compressors using artificial intelligent techniques** Compressed air is typically one of the most expensive utilities in an industrial facility. As a result, potential savings opportunities are aggressively sought out and identified. The methods and techniques adopted to improve energy utilization will vary depending on circumstances, but the basic principles of reducing energy costs relative to productivity will be same. Every industry requires huge manual work, time and support of knowledge experts. Moreover, energy experts are scarce and costly to hire Application of a self decision making industry device will be faster, cost effective and efficient. Factors involved in compressors are vague and uncertain. Hence there is a need for more accurate quicker techniques that can think like humans do. Neural network and fuzzy logic rapidly has become one of the most successful of today's technologies for building sophisticated control system, which handles vagueness and uncertainty. This project proposes the use of neural network and fuzzy logic expert system to find performance of rotary screw compressor. The Monitoring system is developed and validated using MATLAB Neural Network and Fuzzy Logic tool boxes.

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41. **Intelligent Decision Making in Machining**: This project discusses integration issues involved in comprehensive evaluation of *optimized machining performance* for *intelligent manufacturing systems*. Machining performance is evaluated by major measures such as cutting forces/power/torque, tool wear, tool life, chip-form/chip breakability, surface roughness/surface integrity and part accuracy. The machining performance is discussed from a systems framework comprising three primary elements that constitute a machining system; *the machine tool*, *cutting tool* and *work material*. Hybrid methodologies, comprising suitable blends of different modeling techniques are emphasized in this paper. These models can be supplemented by *sensory data*

which defines the unique characteristics of a specific machining system. The modeling of machining performance using traditional techniques, hybrid methodologies and sensor-based information is followed by optimization methods to obtain the optimized machining performance for the specific machining system. The presented methodology provides an effective means for developing intelligent *integrated models and optimization modules* within modern machine tools to enable *instantaneous assessment of machining performance* with suitable on-line process and control strategies. This project proposes the use of neural network and fuzzy logic to perform the prediction of machining parameters. A neural network is created and trained using a set of known parameter values and then checked. This trained network is used for prediction of unknown output values. In fuzzy logic, membership functions are created for corresponding input and output variables and then appropriate rules are formed for the required conditions in machining operation. To check the condition in fuzzy logic simulink tool is used. In simulink work space and display are linked by fuzzy logic controller and condition is predicted for the given variable.

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42. **Modeling and Simulation of PD process**: Product Development (PD) is defined as the translation of new ideas into marketable new products, processes or services. PD gets increased importance in business due to stiff competition and fast changing business environment. Its cycle time is critical as it decides the success of a business. The PD process is made up of all the activities that produce the information and decisions employed in bringing a proposed product to market. PD is a complex activity that requires better management. One of the most effective tools to improve management of PD is simulation modeling. This dissertation developed a method of computer simulation, which could be used as a tool for PD process by incorporating it into organizational models and procedures. The goal of this work is to create a process model that can represent realistic behavior of a complex design project. This model can be used to improve the effectiveness and predictability of such process, accelerate communications among people, and guide project management efforts throughout the development process. This dissertation simulated the product development process in Simquick, Ms Excel and Sim process software.

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43. **Multi objective Optimization of SC**: The concept of Logistics and Supply Chain Management received an increasing attention in recent years. The aim of supply chain management is to coordinate and integrate organizations with conflicting goals to achieve a common goal that maximizes the performance of the total system. Supply chain logistics network decisions have a significant impact on the performance of supply chain. Most of the previous modeling efforts on the supply Chain optimization Logistics network are based on single objective and considers cost as the performance criteria. As supply chain is a complex system with conflicting goals multi objective decision analysis is required to imitate the real life behavior. Hence models that consider not only cost but also other performance measures such as customer service level, volume or delivery flexibility needs much attention. In this paper, a typical Supply chain network having three echelons is modeled mathematically with cost and customer service levels as performance measures. The proposed algorithm gives weightings for criteria using a pair wise comparison approach. It combines analytic hierarchy processes with genetic algorithm to solve the multi-criterion problem.

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44. **Facility Location issues in SCM**: Facility location problems are concerned with optimally locating facilities like warehouses, distribution centers, newspaper stands, schools, hospitals and so on, in such a way that (groups of) customers are served best at the lowest possible cost of building and operating the facilities. Research on facility location problems is abundant and many models have been developed to formulate

and solve various location problems. However the prior work on facility location problems has not considered the special characteristics of large-scale emergency situations in Naval Logistics. In this project we first survey general emergency facility location problems and identify models used to address common emergency situations, such as house fires and regular health care needs. We then analyze the characteristics of large-scale emergencies and propose a general facility location model that is suited for large-scale maintenance emergencies in navel logistics. With the help of Min-Max algorithm & gravity Location method we will try to find out an Optimum Location for an Emergency maintenance service facility for a naval logistics. Further we will try to develop an Analytical Hybrid Method for solving Emergency Location Problems.

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45. **Intelligent Maintenance Management System:** This paper describes the new approach to online fault detection and diagnosis for machining state of grinding. High maintenance costs highlight the need to define clearly the maintenance objectives, to develop and enhance modern maintenance methods continuously, to integrate maintenance and production activities effectively, and to use intelligent computer-based maintenance systems. The intelligent predictive decision support system is developed using fuzzy logic such that system acts as intelligent condition- based fault diagnosis and the power of predicting the machining state of grinding.

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46. **Intelligent Energy Management System:** This project proposes the use of neural network and fuzzy logic expert system to perform energy management in an air compressor. The neural network is trained for optimum output a compressor should give for standard conditions. Hence when an aberration happens it calculates the deviation of the aberration and sends it to the fuzzy inference systems which fuzzifies the input and gives optimum values of process variables in order to reduce the aberration. The optimum values are calculated by neural network and fuzzy logic. Hence the compressor parameters are controlled to optimum level. The energy conserved for a specific period of time is simulated using simulink.This expert system is developed and validated using MATLAB Neural Network and Fuzzy Logic tool boxes. Neural network and fuzzy logic were interlinked with well defined user interface using simu link.

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47. **Modeling and Simulation of Product Development Process** New Product development (PD) is a process road map that guides a new product from ideation through product launch. It is the process of managing activities and resources to bring a new product or service to market. An interdisciplinary and complex activity requires inputs from numerous knowledge domains. It requires the collaboration of professionals over a period of several years. A profitable and successful product is the decisive winning factor in fast changing and competitive market. The ability to accelerate product launch ahead of competitors and within the window of opportunity is more than ever central success. Speed yields competitive advantage as well as higher profitability. The difficulties in global collaborated product development do not arise simply from their technical complexity. The managerial complexity necessary to manage the interactions between various engineering disciplines allocated in different geographical locations imposes additional challenges on the development process in the time-based competition. The real challenge for a new PD project under such circumstances is to overcome the tremendous complexity involved in scheduling and executing a large number of interconnected and dynamic tasks. This project exemplifies modeling and simulation of PD process to estimate PD completion time.

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48. **Multi Objective Optimization of Supply Chain Logistics:** The concept of logistics and supply Chain Management received an increasing attention in recent years. The aim of supply chain management is to coordinate and integrate organizations with conflicting goals to achieve a common goal that maximizes the performance of the total system. Supply chain logistics network decisions have a significant impact on the performance of supply chain. Most of the previous modeling efforts on the supply chain optimization logistics network are based on single objective and considers cost as the performance criteria. As supply chain is a complex system with conflicting goals multi objective decision analysis is required to imitate the real life behavior. Hence models that consider not only cost but also other performance measures such as customer service level, volume or delivery flexibility needs much attention. In this project, a typical Supply chain network having three echelons is modeled mathematically with cost and customer service levels as performance measures. The proposed algorithm gives weightings for criteria using a pair wise comparison approach. It combines analytic hierarchy processes with genetic algorithm to solve the multi-criterion problem.

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49. **Facility Location for Naval Logistics** Companies makes decisions individually and collectively regarding their actions in five areas: production, inventory, location, transportation and information. Facility location decisions have a long-term impact on a supply chains performance because it is very expensive to shut down a facility or move it to a different location. Facility location problems are concerned with optimally locating facilities like warehouses, distribution centers, newspaper stands, schools, hospitals and so on, in such a way that (groups of) customers are served best at the lowest possible cost of building and operating the facilities. Research on facility location problems is significant and many models have been attempted over years. The decision making process for locating a facility involves dynamic, and complex real world multi-criteria decision making problems The Analytic Hierarchy Process (AHP) has been proposed in recent literature as an emerging solution approach to large, dynamic, and complex real world multi-criteria decision-making problems. The AHP has been used in a wide variety of complex decision making problems, such as the strategic planning of organizational resources, the evaluation of strategic alternatives, and the justification of new manufacturing technology. This project details the use of AHP for selecting best location for locating a maintenance facility for naval logistics. An Aggregate Production Planning Model is used to identify Demand and Supply variation on the profitability of the selected location using Microsoft Excel Solver.

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50. **A Neuro-Fuzzy Inference system for Energy Management** Energy management has become vital from the smallest concern to the largest multinationals because of the demand for energy is growing rapidly. More concentration is given to the methods and techniques adopted to improve energy utilization, Such that to reduce energy costs. Energy management requires huge manual work, time and support of knowledge experts. Moreover energy experts are scarce and costly to hire, Application of a self decision making energy management device will be faster, cost effective and efficient. Factors involved in energy management are vague and uncertain. Hence there is a need for more accurate quicker techniques that can think like humans do. Neural network and fuzzy logic rapidly has become one of the most successful of today's technologies for building sophisticated control system, which handles vagueness and uncertainty. This project proposes the use of neural network and fuzzy logic inference system to develop a self-decision making energy management support system. The Feed forward back propagation network is developed and trained for

input and output parameters obtained from the compressor. Fuzzy logic inference system is developed and validated.

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51. **Intelligent Monitoring System for Compressor** Compressed air is typically one of the most expensive utilities in an industrial facility. As a result, potential savings opportunities are aggressively sought out and identified. The methods and techniques adopted to improve energy utilization will vary depending on circumstances, but the basic principles of reducing energy costs relative to productivity will be same. Every industry requires huge manual work, time and support of knowledge experts. Moreover energy experts are scarce and costly to hire Application of a self decision making industry device will be faster, cost effective and efficient. Factors involved in compressors are vague and uncertain. Hence there is a need for more accurate quicker techniques that can think like humans do. Neural network and fuzzy logic rapidly has become one of the most successful of today's technologies for building sophisticated control system, which handles vagueness and uncertainty. This project proposes the use of neural network and fuzzy logic expert system to find performance of rotary screw compressor. The Monitoring system is developed and validated using MATLAB Neural Network and Fuzzy Logic tool boxes.

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52. **ANFIS for Machining** Machining performance is evaluated by major measures such as cutting forces/power/torque, tool wear, tool life, chip-form/chip breakability, surface roughness/surface integrity and part accuracy. The machining performance is discussed from a systems framework comprising three primary elements that constitute a machining system; the machine tool, cutting tool and work material. This paper proposes the use of Adaptive Neuro Fuzzy Inference System (ANFIS) to perform the prediction of machining parameter (surface roughness) for chemical mechanical polishing and tool failure detection in turning process. The architecture and learning procedure underlying ANFIS is presented, which is a fuzzy inference system implemented in the framework of adaptive networks. By using a hybrid learning procedure, the proposed ANFIS can construct an input-output mapping based on both human knowledge (in the form of fuzzy if-then rules) and stipulated input- output data pairs. Over fitting validation for the proposed ANFIS is tested by checking data and testing data as well as checking data are used to test the capability of FIS.

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53. **An Algorithm for Planning of Optimal Stacking** the automated stacking is being important in the sheet metal industries. Because automation takes place the important role in the manufacturing environment. Automated manufacturing systems operate in the factory in the physical product. They perform operations such as processing, assembly, inspection or material handling in some cases accomplishing more than one of these operations in the same system. Because of the above scenario the following work has been developed. The first part of this work describes the development of Integer Linear Programming (ILP) procedure for stacking optimization for the 3D box stacking problem. This work is being extended from the existing work Arghavani and Abdou (1997) and optimizes the volume utilization of master box (MB) with various dimension of rectangular and/or square individual box (IB). The ILP procedure consider the exact location of boxes to be stacked on the pallet and incorporate two successive models with different objectives; the first one is the optimization of the base are of the master box and the second is the optimization of each stacking height for the different sub-areas generated form the first model. One case study with different characteristics has been presented. The second part of this work deals with an algorithm for stacking of identical parts after completing the mechanical operation (like bending). The part in a stack should not interfere with each other and should also satisfy stability, grasping and stacking plan feasibility related constraints. The algorithm has been suggested to stack the identical parts and one

example with various space utilization-weighting factors has been presented. Computer programs, written in Visual C++, stacking procedure drawn in AutoCAD have been developed to simulate the identical parts stacking.

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54. **Selection of Optimal Pin Location for Automatic Part** Handling the advanced manufacturing systems are built with Computer and Numerical Control (CNC) machines, which are automated to move parts between machines store and stack parts. Usually Buffer tables are used as short-term storage in automatic transfer of the parts. Buffer table is a place where part can be put for later retrieval. The Buffer table usually consist of pins, must be capable of positioning and holding the part during the storage. Parts are placed on the buffer table by means of the pins. The stability of work piece is influenced by pin layout selected on the buffer table. Pin lay out design consists of finding the optimum number of pins and their position. Designing a pin configuration (layout) with minimum degrees of freedom under self-weight of the work piece. In this project, an algorithm is developed to design the pin configuration for buffer table that maximizes the stability of the part under self-weight of the work piece. Part geometry and the buffer table parameters are taken as input. The finite element analysis (FEA) is used to find the degrees of freedom of the component for a particular lay out and then the algorithm is used to optimize the number of the pins and their position. Different part geometries and buffer table parameters are used to find the consistency of the algorithm.

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55. **An Intelligent system for Design** In order to improve the productivity automobile industry, the forming technology has developed rapidly, so it is very important to advance the die deign process. It is an iterative procedure of trial and error in order to obtain final die design fro the successful manufacture of forming products. The great development of artificial intelligence technology made it possible to build up intelligent systems to resolve problem, which requires qualitative and ambiguous human experience. Various factors affect the formability of the component in forming die design. In this, drawing force and blank holder pressure plays a vital role. Hence, simulation based die design approach for die design process is followed. Artificial neural network is the preliminary design tools which indicates the force needed toform the component geometry for the selected material and process conditions. The ANN module is trained from the calculated values for the standard dimensions and material properties. The project proposes the use of neural network system to develop a self decision-making die design support system. The feed forward back propagation network is developed the learning algorithm is illuminated and the effectiveness of the model is verified by feeding the network with test data not included in the training data.

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56. **An Intelligent system for Energy Monitoring** Energy monitoring has become vital role in industrial systems because of the demand for energy is growing rapidly. The methods and techniques adopted for efficient energy utilization are planned such that costs are reduced. Energy monitoring requires huge manual work, time and support of knowledge experts. Moreover energy experts are scarce and costly to hire, Application of a self decision making energy monitoring device will be quicker, economic and efficient. Factors involved in energy monitoring are indistinct and uncertain. Hence there is a need for more accurate faster techniques that can think like humans do. Neural network and fuzzy logic rapidly has become one of the most successful of today's technologies for building sophisticated control system, which handles vagueness and uncertainty. This project details the development of an intelligent system for energy monitoring. Energy system for compressor is developed using Neural Network. Simulink is used to build a real time model in simulation environment.

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57. **Prediction of Surface roughness using Neural Networks** Prediction of process parameters is one of the major areas of concern in machining. Machining Performance is evaluated mainly by measures such as cutting forces and by the quality level of surface finish, which directs this project to be done in this category. This project proposes the development of neural network model for machining to predict the surface roughness. The neural network is modeled in a MATLAB platform. The data for training the neural network is collected from the literature. The developed network has cutting speed, feed and depth of cut as input and surface roughness as the output. Visual Basic dot net tool is used for developing the user interface and data interface while the data is handled by MS Access.

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58. **Product Development Process optimization** Responsiveness of the firm has emerged a key factor in deciding the success of the business, amidst escalating pressures created by fast changing technology and market condition. The highly competitive market of this globalized era has imposed a re-look on the conventional product development methods. To make a product to be competitive, it needs to be quickly introduced without compromising on its performance or quality. A product development process (PDP) is a sequence of activities which an enterprise employs to conceive, design and commercialize a product. Reduction of product development cycle time is an essential goal in order to sustain and thrive in the market. The difficulties in developing complex engineering products do not arise from their technical complexity but also from the managerial complexity necessary to coordinate the interaction between different engineering disciplines, which impose additional challenges to the development process. It may be impossible to even predict the impact of a simple design decision throughout the development process. The existing models and methods used by traditional project management approach has proved to be of little worth as far as PDP is concerned as the former failed to meet the PD essentials like representations of feature like resource interdependency, partial allocation and substitution of resource and mutual exclusivity, ability to deal with both deterministic and stochastic activities expressive graphical representation, sensitivity analysis and capacity to review the plan transient and stationary periods. The dissertation developed a simulation based framework that determines the optimal sequence of activities execution within a PDP that minimizes project total iterative time given stochastic activity durations.

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59. **Modeling of Manufacturing Projects** In today's competitive environment, manufacturing firms face unprecedented demands for quality and increased sophistication in product requirement from customers. These are coupled with increasing complexities in technology and reducing product life cycles. Management is continually seeking new and better control techniques to cope with the complexities, masses of data, and tight deadlines that are characteristic of highly competitive industries. Managers also want better methods for presenting technical and cost data to customers. Project Management approach is drawing increased attention in Modern Manufacturing as it is tied up with high technology and requires coordinated efforts of all connected with a system. Project Management techniques form an essential decision making tool in manufacturing system. Project network techniques are universally used to plan, schedule and control business. These techniques help management to evaluate alternatives by answering such questions as how time delays will influence project completion, where slack exists between elements, and what elements are crucial to meet the completion date. Project Management functions are performed using traditional techniques like PERT. But traditional project management tools and other revised tools are limited in representation of the problem and in dealing situation dynamically. Project work proposes the use of MS Excel and Sim Quick in simulation

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60) **A Decision making strategy for supply chain** (May 07) As the industrial environment becomes more competitive, the concept of Logistics and Supply Chain Management received an increasing attention in recent years. The aim of supply chain management is to coordinate and integrate organizations with conflicting goals to achieve a common goal that maximizes the performance of the total system. Supply chain logistics network decisions have a significant impact on the performance of supply chain. Most of the previous modeling efforts on the supply Chain optimization Logistics network are based on single objective and considers cost as the performance criteria. As supply chain is a complex system with conflicting goals multi objective decision analysis is required to imitate the real life behavior. Hence models that consider not only cost but also other performance measures such as customer service level, volume or delivery flexibility needs much attention. In this project, a typical supply chain network having two echelons is modeled mathematically with cost and customer service levels as performance measures. Evolutionary algorithm namely particle swarm optimization algorithm is proposed to arrive at near-optimum solutions. The performance of the algorithm is exemplified

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61 An Intelligent tool design system (May07): The objectives of an intelligent tool design system are to make a self decision making system in the process of tool design. The tool design process is an iterative procedure of trial and error method and it is automated to improve productivity in the proposed design method unigraphics interactive programming, artificial neural networks and finite element analysis are used. The simulation based design approach is followed for the project work. Component geometry is a critical parameter, which affects the manufacturability of the given part. ANNS are proposed and developed for preliminary design of the optimum parameters for the components geometry. The final dye and punch assembly model is developed for the optimum parameters using GRIP

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62 Development of Energy Management System using Fuzzy logic: (May07)The objective of energy management system is to improve energy consumption efficiency, reduce cost, reduce environmental and greenhouse gas emissions, and conserve natural resources. The conventional air conditioning system is controlled by a thermostat with a set point for the targeted temperature. Human comfort is realized at temperature 20-25°C and humidity of 40-70 %.In the proposed method, temperature and humidity sensors captured the readings from an air conditioned room. The readings are compared with the target values set by the user and the corresponding differences are fuyzzied. These differences are used to decide the fuzzy qualifier, which is decoded into a crisp value that is the change required in the setting of temperature. Consequently an air conditioning unit will maintain a temperature near 25°C and a relative humidity near 70% while the compressor will remain off for an appreciable period leading to saving of energy.

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63 Deflection of turning tool using Ansys (May07): Stability analysis is one of the important investigations in metal cutting process. Modeling and simulation of cutting process have the potential for improving tool designs and selecting the cutting condition, especially in the case of deflection analysis. Finite element method is a powerful tool to predict the cutting process variables, which are difficult to obtain with experimental methods. This work focuses on the use of structural FEM in the stability analysis of cutting operations. ANSYS (10.0) was used for both modeling and analysis work experimentally determined of the tool model was predicted. When the tool model was mainly subjected to cutting forces, the deflection at the tip of the model was found to be marginally higher than theoretically calculated values due the inclusion of steriometric details in the actual model, where as in the theoretical calculations the tool sis considered to be uniform cross section and also due to conjoint application of all the three forces on the tool model, where as in the theoretical cutting force

alone applied. FEM gives more accurate details than theoretical values for optimal design of cutting tools

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64 Design Process Sequencing using DSM and nontraditional techniques (May07): A product development process is a sequence of activity, which an enterprise employs to conceive, design and commercialize a product. Reduction of product development cycle time has become an essential goal in order to thrive and sustain in the market. Companies are forced to develop well coordinate development plan to organize their process and resources to develop competitive products. Project management approach has been identified as a useful tool for managing PD. Since PD process involves large amount of information flow and associated iteration, the traditional project management techniques are limited in application for its management. Information flow models have been emerged as a new tool for managing information exchange and iteration. A powerful information flow model called Design structure Matrix (DSM) is used in this work to sequence the engineering design process to minimize feedback and iteration, to maximize the availability of real information where assumptions might otherwise be made instead. the application of nontraditional search technique has potential to improve the quality of the solution within the reasonable time frame . Nontraditional search techniques are applied to the information flow model to find an optimized sequence for a set of design activities that minimizes total design iterative time.

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65 Resource Allocation in software projects using GA (May07): The concept of supply chain management has received an increasing attention in recent years. The aim of SCM is to coordinate and integrate organizations with conflicting goals to achieve a common goal that maximizes the performance of the individual as well as the total system. Supply chain analysis can be performed at different stages. Supply chain logistic planning decisions have a significant impact on the performance of supply chain. Most of the previous modeling efforts on the supply chain logistics network optimization are based on single objective and considers cost as the performance criteria. As supply chain is a complex system with conflicting goals multi objective decision analysis is required to imitate the real life behavior. Hence models that consider not only cost but also other performance measures such as customer service level, volume or delivery flexibility needs much attention. in this project, a typical supply chain network having two echelon is modeled mathematically with the objectives of minimizing the cost of production and distribution and maximizing the service level which is measured in terms of the delivery days. For multi objective optimization problems that are combinatorial in nature, evolutionary algorithms like genetic algorithm, particle swarm optimization and simulate annealing are proved to be efficient in finding a set of Pareto optimal solution. Among the evolutionary particle swarm optimization Algorithm that can efficiently handle two objective problems is selected as solution methodology. The performance of the algorithm is exemplified.

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66 Optimization of supply chain logistic network using SFHA (May07): Supply chain logistics planning decisions have a significant impact on the performance of supply chain. Supply chain problems are been attempted using traditional techniques like mathematical modeling. These techniques are limited in handling large scale problems. In recent past the researchers have been attempting nontraditional search technique for solving such problems. This project work scopes the application of nontraditional search techniques in optimization of the supply chain logistic networks. It is to determine the quantities of the production and distribution in integrated production distribution system for multiple periods. A supply chain network having two echelons is modeled with the objective of minimizing the cost of production and distribution for multi periods. A new evolutionary SFA based on SFH is proposed and

modeled to handle the multi period optimization problems. A numerical example is employed to illustrate the effectiveness of the proposed algorithm. The performance of the proposed algorithm is compared with the other nontraditional techniques like GA, particle swarm optimization

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67 Selection of optimum maintenance strategy using MCDM technique (Dec07): The maintenance management is attaining more attention in the JIT manufacturing environment. The organizations are looking for increasing profit by continuous running of the organization. In order to achieve goal of the organization, it has to adopt optimal maintenance strategy. An optimum maintenance strategy mix is necessary for increasing the availability and reliability of the equipments without much increase of the investment. The maintenance strategy selection is a typical multi criteria decision making problem. The AHP, TOPSIS, and Fuzzy AHP techniques are adopted for selecting the best maintenance strategy. These MCDM techniques are applied to textile and power plant industry and it is found that the predictive maintenance strategy is the optimal strategy in both cases. Strategy will depend on the criteria considered by organization.

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68 Multi-criteria decision making in supply chain using NSGA II : A supply chain is defined as an integrated system or network which synchronizes a series of inter related business activities. the supply chain network (SCN) design involves multiple objective such as cost, service level, resource utilization etc, strategic decision on establishing a SCN includes determination of number, location , capacity of plants, warehouses, distribution centers, planning of distribution channels and amount of products to be shipped between entities . Distribution planning decision has a major impact on the performance of the SCN as they affect both cost and service level. Increment of customer service level will usually increase cost. These types of conflicting objectives are solved through the multiple objectives into single scalar objective by arbitrary determination of weights that may result in skipping better solution to a problem. Evolutionary algorithm such as GA, PSO are proved to be efficient in finding a set of pareto optimal solution for MOP without the arbitrary determination of weights applications of evolutionary algorithms for multi objective optimization needs attention. In this work, a three stage supply chain network is modeled mathematically with the objective of minimizing the cost and distribution lead time. A multi objective genetic algorithm NSGAII). The performance of proposed algorithm is exemplified using a simulation data

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69 **Optimization of CNC turning using GREY relation analysis:** Optimization of process parameters is the key step in the Taguchi methods to achieve high quality without cost inflation. Optimization of multiple performance characteristics is more complex compared to optimization of single performance characteristics. This project work deals with a multi-performance optimization technique, based on grey relational analysis, to optimize the cutting parameters in turning processes: cutting depth, feed and speed. Two performance characteristics material removal rate (MRR) and surface roughness, are simultaneously optimized. An orthogonal array was used for the experimental design. CVD coated carbide insert as tool and Hardened steel as work piece material were used in experiments. In the grey relational analysis method experimental data are first normalized in the range between zero and one, which is also called the grey relational generation. Next the grey relational coefficient is calculated from the normalized experimental data to express the relationship between the desired and actual experimental data. Then, the grey relational grade is computed by averaging the grey relational coefficient corresponding to each performance characteristic. The overall evaluation of the multi- performance characteristics is based

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70 **Modeling of extended enterprises** : Manufacturing system are subject to tremendous pressures because of the ever changing marketing environment, the traditional view of manufacturing companies with clear boundaries, limited relationships with other companies and a focus on internal efficiency and effectiveness is no longer adequate.. Today's organizational boundaries are blurring, parternership with suppliers, clients and even competitor are commonplace and quality and efficiency issues extended well beyond the traditional enterprises boundary. Crossing boundary business activities are also enabled by state of the art information and telecommunications technologies. Individual companies' works together to form inter enterprise networks across the product value chain, in order survive and achieve business successes. The challenge for the future is to consider the extended enterprise and facilitate inter enterprise networking across the value chain. this type of manufacturing concept is termed the Extended Enterprise(EE). According to this concept, several legally independent enterprises, institution or single person joint together to co-operate for a particular mission. The highly complicated network of enterprise often faces different managerial issues. The success of this extended enterprises depended on how well these problems are solved. Selection of best partners is important to form a quality organization. This project is an attempt to find the key issues in the extended enterprise environment and the methods to solve such issues

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71 Optimization **of CNC turning using Ann and fuzzy logic :** Prediction of process parameters is one of the major areas of concern in machining. Machining Performance is evaluated mainly by measures such as cutting forces and by the quality level of surface finish, which directs this project to be done in this category. This project proposes the regression model using regression analysis and the development of neural network model for machining to predict specific power consumption, material removal rate and the surface roughness. The neural network is modeled in a MATLAB platform. The data for training the neural network is collected from the literature. The developed network has cutting speed, feed and depth of cut as input and specific power utilization, material removal rate and surface roughness as the output. Also optimization of machining parameters also has been carried out using Taguchi based Fuzzy approach on the grey relational grade. As a result, optimization of complicated multi-performance characteristics can be converted into optimization of a single grey relational grade. In other words the grey relational grade can be treated as the overall evaluation of the experimental data for multi performance characteristics. The optimal level of the process parameters is the level with the highest grey relational grade. Experimental results have shown that the specific energy consumption and the MRR in the turning process can be improved effectively through the new approach

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72 **Integrated maintenance and production scheduling using evolutionary algorithms :** Preventive maintenance planning and production scheduling for a single machine is formulated as a multi-objective mathematical optimization problem. Despite the inter-dependent relationship between them, production scheduling and preventive maintenance planning decisions are generally analyzed and executed independently in real manufacturing systems. Preventive maintenance and repair affect both available production time, and the probability of machine failure. We propose an integrated model that coordinates preventive maintenance planning decisions with single-machine scheduling decisions so that the total weighted expected completion time of jobs is minimized. The optimal production scheduling is found by the weighted shortest processing time rule. The preventive maintenance planning is integrated with the corresponding optimal production scheduling so that the total weighted expected completion time of jobs is minimized. The integrated problem became complex combinatorial problem. This problem can be solved by the evolutionary algorithms. The artificial immune system and sheep flock heredity algorithms are proposed to

solve the integrated optimization model for production scheduling and preventive maintenance planning. The numerical results on several problem sizes indicate that the methodologies' feasibility and efficiency. We compare the performance of the integrated solution with the solutions obtained from solving the preventive maintenance planning, and job scheduling problems independently. For the problems studied, integrating the two decision-making processes resulted in an average improvement in the objective function.

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73 Selection of Partners in Extended enterprise using Evol. Algorithms: The highly complicated network of enterprise often faces different managerial issues. As the EE environment continues to grow in size and complexity, the importance of managing such complexity increases. The success of this extended enterprise depends on how well these problems are solved. One of the key problems of extended enterprise's success is how the dominant enterprise selects the proper cooperative partner. Finding the right partners and establishing necessary conditions for starting the extended enterprise is a costly and time consuming activity .Overcoming the mismatches resulting from the heterogeneity of potential partners requires considerable investment, building trust, a pre-requisite for any effective collaboration, is not straight forward and requires time. Selection of partners depends on various qualitative and quantitative factors. Although the partnership selection problem is considered as critical in the formation of Extended Enterprise, only few formalized decision making methods have been proposed in the literatures. Many studies have been done on the vendor selection in supply chain but modeling of extended enterprise is a new area for the researchers and practitioners. Selection of partners in extended enterprise is a multi objective optimization problem. Some of the Multi objective optimization methods supporting optimal selection of partner companies for a business initiative in an extended enterprise environment are discussed and critically evaluated in this project.

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74 Multi-criteria decision making in multi echelon supply chain using NSGA II： A supply chain refers to a network of entities such as suppliers, manufacturers, distributors, retailers and customers. Managing the entire supply chain becomes a key factor for the successful business. The Supply Chain Network (SCN) design involves multiple objectives such as cost, service level, resource utilization etc. Strategic decisions on establishing a SCN includes determination of number, location, capacity of plants, warehouses, distribution centers, planning of distribution channels and amount of products to be shipped between entities. Distribution planning decisions have a major impact on the performance of the SCN as they affect both cost and service level. Goal of achieving higher customer service will usually increase cost. These types of conflicting objectives are solved through the Multi Objective Programming (MOP). Traditional MOP techniques combine multiple objectives into a single scalar objective by arbitrary determination of weights that may result in skipping better solutions to a problem. Evolutionary Algorithms (EA) such as GA, PSO are proved to be efficient in finding a set of Pareto optimal solutions for MOP without the arbitrary determination of weights. Application of evolutionary algorithms for multi objective supply chain network optimization needs attention. In this work, two different models are formulated. In model 1 total cost and total delivery lead time are considered as the performance criteria and NSGAII is proposed as solution methodology. The proposed algorithm is validated against random weight based genetic algorithm in terms of average number of Pareto optimal solutions. In model 2, a three stage supply chain network is formulated mathematically with the objective of minimizing the cost, demand response time and maximizing volume flexibility. Priority based encoding and integer based encoding are proposed instead of matrix based representation. This avoids complexity of repairing mechanism and saves much of the computational time. NSGAII is proposed and the performance of algorithm is exemplified using simulated data

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75 Resources allocation the techniques for project : A Project is major undertaking dedicated to some well defined objective and involving considerable resources like

money, personnel and equipment. If the Resources are available in abundance then the project could be accelerated to achieve shorter project duration. If the resources are severely limited, then it will result a delay in the project completion time. Each project task may be executed more than one manner, depending on which resources are assigned to it. Apart from precedence relationship and activity pre- emption the resource allocation became complex task due to the dynamic changes in the resource requirements and its availability with multi objectives. Generally the resource allocation problems are time-cost-tradeoff problem, project duration problem and leveling problem. Minimizing make span and maximizing NPV has been the dominant objectives of much of research to date, there are considerable opportunities in investigating other objectives that combine these with costs, leveling resources, and so on. Many Algorithms and heuristics approaches are developed to solve the resource allocation problems. Mathematical Programming attempts are more suitable for single objective optimization. It is static and difficult in representing conflicting objectives Heuristic programming methods are problem specific and converge in near optimal solution similar to the Knowledge-based approaches. Neural networks attempt to detect patterns that may be similar to known good schedules and Genetic Algorithms attempt progressively find better project plans based on specialized search operations.This project describes the applications of mathematical modeling, simulation, heuristics and Microsoft Project 2007 software to resource allocation problems. This project work scopes the development of a generic method for resource allocation of projects which should addresses the dynamic characteristics like change in resource availabilities, change in resource requirements and change in objectives.

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76 Multiple criteria decision making for supplier selection : Supplier selection is a multi-criteria decision problem that includes both qualitative and quantitative criteria. In order to select the best suppliers it is necessary to make a tradeoff between conflicting tangible and intangible factors. Selecting the best supplier among a group of suppliers and computing the optimal order quantity from them remains the two main problem area in these problems. Till now, Data Envelopment Analysis, Analytical Hierarchy Process, Fuzzy Analytical Hierarchy Process, TOPSIS and ELECTRE are the main methods that have been used to solve this type of problems. Here in this work, we have discussed the various methodologies in multi-criteria decision making like Data Envelopment Analysis, Analytical Hierarchy Process and Fuzzy Analytical Hierarchy Process. Linear programming model (LPM) is proposed for obtaining the optimum quantities among selected suppliers to maximize the total value of purchasing (TVP). The priorities of suppliers will be used as the parameters of the objective function. A numerical example is presented to explain the method of research

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77 Technique for life cycle costing analysis : This project describes the concept by the customer view of the consuming life cycle. Because the purchase price the customer pays is equal to the cost of the producer plus value added, the life cycle costs of the customer perspective will most often be complete. The project focuses on the customer's perspective to the lifecycle costs and not so much on the product life cycle. This study utilizes a combination of product life cycle analysis, and regression data analysis processing for the product maintenance costs calculations in its life cycle. The combination is necessary for solving the research task; life cycle costs analysis considers only product maintenance costs in this project. In this project the lifetime is taken as a cost driver to allocate the maintenance costs between different trucks in their different lifetime. This study presents the evaluation of the regression functions, describes its elements, illustrates the comparison and chooses the best. The life cycle curve's estimation shows that the longer exploitation period is, the bigger maintenance costs are. This can help to make a decision about the further exploitation of the truck

during its valuable life cycle and after it. It is the main purpose why life cycle costing system was created and developed; using non-traditional life cycle costing curve estimation. The companies should use exponential regression formula for allocating maintenance costs to different trucks in order to get the most exact result for cost management. The main aspect of this method is that the chosen interval should be isolating and it should meet all the requirements for isolating interval: 1. Function changes its sign in the interval; 2. the first derivative function does not change its sign in the interval; 3. the second derivative function does not change its sign in the interval. The simulation methodology and scenario analysis are used for solving case examples.

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78 Evaluation of manufacturing strategy : Manufacturing enterprises are facing critical challenges to reconstruct themselves in order to survive in a volatile competitive market environment. Their successes largely depend on their ability to quickly practice and adopt state-of-the-art manufacturing strategies and technologies. The complexity of the systems requires consideration of many tangible and intangible decision factors for their evaluation. Today's manufacturing strategy is purely a choice of alternatives. The better the choice more will be the productivity as well as the profit maintaining quality of product and responsiveness to customers. In this era of rapid globalization, the overall objective is to purchase a minimum amount of capacity (i.e., capital investment) and utilize it in the most effective way. Until recently, many ranking and scoring methods or multi-criteria decision methods are used to evaluate the manufacturing system alternatives. Methods developed in the past are useful in addressing subsets of factors, but fall short in a comprehensive system analysis. Classical MCDM methods couldn't effectively handle problems with imprecise information. To resolve this difficulty, fuzzy MCDM methods are proposed. In the present work, an Integrated Fuzzy MCDM is proposed, which integrates the results of financial and strategic evaluation. To increase the objectivity and responsiveness of the results, Fuzzy MADM Based on Eigenvector of Fuzzy Attribute Evaluation Space or Improved Fuzzy AHP is proposed.

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79 Welding analysis using finite element simulation: : Many engineering and structural components are processed using welding through established procedure. The procedure has a direct influence on the integrity of the components and their thermal and mechanical behavior during service. Due to the high temperatures introduced during welding and the subsequent cooling of the welded metal. Welding can produce undesirable residual stresses and deformations. It is of important interest to simulate the process of welding to delineate the ensuing residual stresses and deformations and predict the behavior of welded structures. Finite element simulation of the welding process is a highly effective means of predicting thermo mechanical behavior, to enhance the accuracy of the numerical solution and bring it close to the real situation. The objective is to investigate the effect of each temperature- dependent material property on the transient temperature, residual stress and distortion in computational simulation of welding process. The scope of simulation has matured from single-component analyses to multiple-component assemblies, and to entire systems analyzed for cost, reliability and performance. The role that FEA has played in the product design cycle has expanded from simple failure analysis to design verification, to design guidance and optimization. Today's FEA is a tool that plays a key role in engineering design and follows a product through its entire life cycle. The FEA can predict the effects of stress, temperature, pressure, and motion on a design, instead of investing in expensive prototypes and testing, these developments not only because of the technology promises of the day, but because this technology could serve to slash design costs. The present study concerns the development and experimental validation of a finite element Analysis to simulate the welding process

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80 Modeling and analysis of electrical discharge of machining process : This project is aimed to develop a model determine optimal combinations of various control factor measures using Taguchi's parameter design. The significant machining parameters affecting the performance measures are identified as discharge current, pulse duration, pulse frequency and flushing pressure. The experiments were conducted for each combination of factors for optimization of each performance measure is different. In this work, the relation between control factors and responses like MRR and TWR are established by means of Taguchi technique and regression analysis, resulting in a valid mathematical model

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81 Resource allocations in projects using nontraditional techniques : A project consists of a set of activities with precedence relationships and need variety of resources for completion. These project-scheduling problems are solved by resource allocation to minimize the time and the cost to complete the entire project. These are classified as resource constrained project scheduling problems when the resources are limited and as multi-modal resource-constrained project scheduling problems when each task may execute in more than one mode and each mode may have different resource requirements. In multi-project scheduling problems, more than one project is scheduled. Many Algorithms and heuristics approaches are developed to solve these resource allocation problems. Mathematical Programming limited for single objective optimization and is static and difficult in representing conflicting objectives. Heuristic programming methods are problem specific and converge in near optimal solution similar to the Knowledge-based approaches. Neural networks attempt to detect patterns that may be similar to known good schedules. Nontraditional optimization techniques are been attempted by many researchers in solving combinatorial optimization like resource allocation in projects. This project work proposes the use Genetic Algorithm (GA) and Bacteria Foraging Optimization (BFO) algorithm for allocating the resources in projects.

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82 Development of supplier selection model and order quantity estimation The increasing competition has been forcing the manufacturing firms to quickly respond to the dynamic demands of the customers. The modern manufacturing paradigm necessitates the adoption of Supply Chain practices. Supply chain encompasses all activities associated with the flow and transformation of goods from the raw material stage through to the end user as well as the associated information flows. Supply chain management focuses on improvement of customer service, profitability and business performance. The cost of raw materials amounts to majority of the cost in leading companies. Strategic partnership with better suppliers need to be formed to improve quality, reduce lead time and improve flexibility. Supplier selection in company is a cross-functional, group decision making problem, ensuring long term commitment for an organization. Supplier selection is a decision making process at the strategic level. Many approaches are proposed in the literature for supplier selection. In this project, techniques such as strategy-aligned simple multi- attributes rating technique (SMART) and combined analytical hierarchy process (AHP) and grey relational analysis (GRA) has been used for supplier selection. Thecase study has been carried out for a pump manufacturing company situated in Coimbatore and the optimal order quantity has been estimated by mixed integer programming.

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83 Manufacturing strategy analysis by simulation : This project is focused on the analysis of manufacturing strategies for a rapidly changing manufacturing environment and the firms which experience frequent introduction of new products into the market. Product-mix is an important decision for efficient manufacturing. The objective of the product-mix decision is to find the product mix that maximizes the total contribution to profit subject to constraints of resource limitations, market demand, and sales

forecast. Simulation provides an effective way for a company to evaluate impact of introducing a new policy or layout on productivity. Computer simulation models the real life system and is able to run what- if scenarios quickly, which helps to understand and evaluate the system. In this project, a methodology of simulating the production line is proposed. A multi attribute decision method (MADM) is proposed for product mix decision making. Illustrative examples are presented to appreciate the methodology using WITNESS. Two industrial case studies are conducted and reported.

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84 Case study on life cycle costing Analysis : Life cycle cost management has gained importance in the decision making process for new technology, design and procurements. Life cycle cost is the amortized annual cost of a product, including capital costs, installation costs, operating costs, maintenance costs, and disposal costs discounted over the lifetime of a product. Application of LCC techniques provides management with an improved awareness of the factors that drive cost and the resources required by the purchase. It is important that the cost drivers are identified so that most management effort is applied to the most cost effective areas of the purchase. This project work defines the case studies that support the life cycle cost analysis. The first case study discusses about the life cycle costs and the role of various costs in planning. The problem involves fuel cost, maintenance cost, insurance cost and salvage costs. The total life cycle cost for a multiple car problem is calculated by using MS-Excel. It gives a clear idea to the buyer before buying an automobile. The second case study discusses about a developed mathematical model for calculating the life cycle costs for a project where the operating costs increase or decrease in a linear manner with time. The life cycle cost is shown to be a function of (1) investment costs (2) initial operating costs (3) operating cost gradient (4) project life time (5) interest rate for capital and (6) salvage value. The third case study discusses in light of escalating fuel prices and the ongoing climate change discussion, sustainability considerations are currently taking a more prominent role in material selection decisions for automotive applications. This study is aimed at developing a new sustainability model to quantify the total cost encountered over the entire life- cycle of a vehicle considering all four life-cycle stages: (1) pre-manufacturing, (2) manufacturing, (3) use and (4) post-use.

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85 Optimization of Electrical Discharge machining parameters using ANN and GA : Electric Discharge Machining(EDM) is a thermo electric non-traditional machining process in which material removal takes place through the process of controlled spark generation between a pair of electrodes which are submerged in a dielectric medium. Electric Discharge Machining (EDM) is extensively used in a machining of conductive materials when precision is of prime importance. The cutting operation in EDM is challenging and improvement of more than one machining performance measures viz. Metal removal rate (MRR) , tool wear rate (TWR) and surface finish (SF) are expected. The present work is aimed at optimizing the process parameters of die sinking Electric Discharge Machining (EDM) by considering the simultaneous affect various input parameters. The experiments are carried out on AiSiD3 material with kerosene as dielectric. Experiments were conducted according to the L27 orthogonal array design by varying different input parameters and the corresponding values of metal removal rate (MRR) and tool wear rate (TWR) were measured. Feed-forward back propagation neural network models were developed and used for predicting the parameters using MATLAB software. Regression analysis is done to develop the best fitness function for the given data using MINITAB 14 software. The process parameters are optimized using genetic algorithm by using MATLAB software. Conformation experiments were conducted to validate the results given by ANN and GA.

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86 Optimization of welding parameters using neural network and genetic algorithm: W elding is a basic manufacturing process for making components or assemblies. Resistance spot welding is a process that is being widely used in the industry for sheet joining process. Recent welding economics research has focused on developing the reliable machinery database to ensure optimum production. The development of neural network model for welding to predict the failure stress. The neural network model is developed in MATLAB platform. The data for training the neural network is collected from the Finite Element Analysis. The developed network has welding current, electrode stress and cycle time as input and failure stress as the output. An optimization method based on genetic algorithms is then applied to resolve the FEA model and to select the optimum welding parameters. These parameters are used to obtain the preferred welding quality at the least possible cost. It enhances quality of the joint and will result in improving overall quality of the body

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87 Performance Measurement of supply chain using DEA and MCDM Technique From evolution of supply chain management, a steady stream of articles dealing with the theory and practice of SCM has been published, but the topic of performance measurement has not received necessary attention until 2001. As an indispensable management tool, performance measurement provides necessary assistance for performance improvements, in pursuit of supply chain excellence. A number of reasons exist for measuring and evaluating the supply chain performance. Firstly, measurement can lead to better decision making and can result in better communication across the supply chain. Measurement also provides the opportunity for feedback, which supports the prevention or correction of problems identified during the performance measurement process and can motivate and direct toward desired end results. The Data Envelopment Analysis models, namely: basic, super efficiency models were used for data analysis. This approach helps to identify the efficient and inefficient zones. The principle of DEA/AHP method is using the evaluating result of DEA to construct the judging matrices of AHP and then using theAHP method to rank the DMUs. It can overcome the ranking constraints of DEA and the subjective flaw of AHP at the same time. Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) which is one of the multi criteria decision making (MCDM) technique. From the relative closeness to the ideal solution of TOPSIS the ranking are given and their performance are measured.

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88 **Facility Location using multi criteria decision making techniques** Companies make decisions individually and collectively regarding their actions in five areas: production, inventory, location, transportation and information. Facility location decisions have a long-term impact on a supply chains performance because it is very expensive to shut down a facility or move it to a different location. Facility location problems are concerned with optimally locating facilities like warehouses, distribution centers, newspaper stands, schools, hospitals and so on, in such a way that (groups of) customers are served best at the lowest possible cost of building and operating the facilities. Research on facility location problems is significant and many models have been attempted over years. The decision making process for locating a facility involves dynamic, and complex real world multi-criteria decision making problems The Analytic Hierarchy Process (AHP) and TOPSIS has been proposed in recent literature as an emerging solution approach to large, dynamic, and complex real world multi-criteria decision-making problems. The AHP has been used in a wide variety of complex decision making problems, such as the strategic planning of organizational resources, the evaluation of strategic alternatives, and the justification of new manufacturing technology. The basic concept of the TOPSIS method is that the selected alternative should have the shortest distance from the ideal solution and the furthest

distance from the negative-ideal solution in a geometrical sense. This project details the use of AHP and TOPSIS for selecting best location and comparing these two methods for locating a maintenance facility for naval logistics.

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89 Selection of Maintenance Strategy using fuzzy inference system and ANN The Fusion of Artificial Neural Networks (ANN) and Fuzzy Inference Systems (FIS) have attracted the growing interest of researchers in various scientific and engineering areas due to the growing need of adaptive intelligent systems to solve the real world problems. A neural network learns from scratch by adjusting the interconnections between layers. Fuzzy inference system is a popular computing framework based on the concept of fuzzy set theory, fuzzy if-then rules, and fuzzy reasoning. The advantages of a combination of neural networks and fuzzy inference systems are obvious. An analysis reveals that the drawbacks pertaining to these approaches seem complementary and therefore it is natural to consider building an integrated system combining the concepts, while the learning capability is an advantage from the viewpoint of fuzzy inference system, the automatic formation of linguistic rule base will be advantage from the viewpoint of neural network. In the simplest way, a cooperative model can be considered as a preprocessor. Where in artificial neural network (ANN) learning mechanism determines the fuzzy inference system (FIS) membership functions or fuzzy rules from the training data. Once the FIS parameters are determined, ANN goes to the background. If a fuzzy set is seen as a point in the unit hypercube and rules are associations, then it is possible to use neural associative memories to store fuzzy rules. A neural associative memory can be represented by its connection matrix..

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90 Facility Location Selection using MCDM methods and K Means Clustering Companies make decisions individually and collectively regarding their actions in five areas: production, inventory, location, transportation and information. Facility location decisions have a long-term impact on an Enterprise performance because it is very expensive to shut down a facility or move it to a different location. Facility location problems are concerned with optimally locating facilities like warehouses, distribution centers, newspaper stands, schools, hospitals and so on, in such a way that (groups of) customers are served best at the lowest possible cost of building and operating the facilities. Research on facility location problems is significant and many models have been attempted over years. In this project it is assumed that location exist in m-dimensional space where each dimension represents some criterion/attribute for selection. PROMETHEE is a quite simple ranking method in conception and application compared with other methods for multicriteria analysis. It is well adapted to problems where a finite number of alternatives are to be ranked considering several, sometimes conflicting criteria. It is Rank decisions from the best to the worst ones and also identify best compromise solutions. The advantage of the SMART Techniques is that the ratings of alternatives are not relative, so that changing the number of alternatives considered will not, in itself, change the decision scores of the original alternatives. It is a simpler implementation linear form method and direct entry of relative scores & weights. The process of clustering identifies a working set of better locations and the scoring method selects the Most Suitable Location from the set. This project details the use of K-means clustering, PROMETHEE and SMART for selecting best location for locating the new facility location problem.

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91 **Measuring Performance of Supply chain using DEA and MCDM Techniques** Success of a supply chain depends on performance measurement system. Traditional performance measurement methods are limited in application. The Balanced Score Card is used to measure the performance of any supply chain. But in the case of benchmarking and measuring the performances of similar supply chain. The Balanced score card can be used but after classifying them under four perspective, to compare

among the similar supply chain MCDM technique are used. Data Envelopment analysis (DEA) is an ideal method for evaluating the performance of supply chain. It is a technique that allows for the simultaneous evaluation of multiple inputs and multiple outputs to calculate a single comprehensive measure of efficiency. DEA models differentiate the efficient decision making units (DMU) from inefficient ones. It has become an increasingly popular management tool for performance measurement and benchmarking.. However, the evaluating results of DEA model can only divide the units into efficient and inefficient classes, which can not satisfy the practical need to rank all the units under one standard. The DEA/AHP model to overcome the limits of the DEA method and the AHP (Analytical hierarchy process) method respectively, it ranks the decision making unit. Similarly technique for orderperformance by similarity to ideal solution (TOPSIS) is one of the multi criteria decision-making technique which is integrated with DEA to measure the performance of the supply chain

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92 **Selection of maintenance strategy using MCDM methods and clustering techniques.** The maintenance management is attaining more attention in the JIT manufacturing environment. The organizations are looking for increasing profit by continuous running of the organization. In order to achieve goal of the organization, it has to adopt optimal maintenance strategy. An optimal maintenance strategy is necessary for increasing availability and reliability levels of production facilities without a great increasing of investment. The selection of maintenance strategies is a multiple-criteria decision-making (MCDM) problem. To deal with the uncertain judgment of decision makers ELECTRE and VIKOR methods are applied as an evaluation tool and also CLUSTERING ALGORTHIM is introduced for choosing the best maintenance strategy for the first time. Multiple criteria decision making (MCDM) is the tool most frequently used to deal with conflict management. Practical problems are often characterized by several non-commensurable and conflicting criteria, and there may be no solution satisfying all criteria simultaneously. Therefore, the solution is a set of non-inferior solutions, or a compromise solution according to the decision makers' preference. A compromise solution for a problem with conflict criteria can allow the decision makers to reach a final decision. The compromise solution is a feasible solution closest to the ideal/aspired level and a compromise means an agreement established by mutual concessions. The ELECTRE evaluation method is widely recognized for high-performance policy analysis involving both qualitative and quantitative criteria. However, a critical advantage of this evaluation method is its capacity to pinpoint the exact needs of a decision maker and suggest an appropriate evaluation approach. The possible effect triggered by the absolute value of the maximum differentiated performance and the absolute value of the sum of differentiated performance is analyzed under the two discordance index evaluation standard. The VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje in Serbian, means Multi-criteria Optimization and Compromise Solution) method introduced the multi-criteria ranking index based on the particular measure of closeness to the ideal/aspired level solution and was introduced as one applicable technique to implement within MCDM. The VIKOR method was developed as a multi-criteria decision making method to solve discrete decision problems with non- commensurable and conflicting criteria. This method focuses on ranking and selecting from a set of alternatives in the presence of conflicting criteria, which could help the decision makers to reach a final decision. Clustering is an important unsupervised learning technique widely used to discover the inherent structure of a given data set .Some existing clustering algorithms uses single prototype to represent each cluster, Cluster analysis groups data objects based only on information found in the data that describes the objects and their relationships. The goal is that the objects within a group be similar to one another and different from the objects in other groups. The greater the similarity within a group and the greater the difference between groups, the better or more distinct the clustering

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93. MODELING AND ANALYSIS OF ASSEMBLY SEQUENCE PLANNING

Assembly sequence planning (ASP) aims to identify and evaluate the different ways to construct a mechanical object from its component parts. An assembly sequence planner is a system based on the graphical description of a composite object called assembly or subassembly identifies the parts that construct that object and generates assembly sequence plans. Each plan specifies the collection of insertion operations to be carried out and the order in which these operations have to be performed. An insertion operation moves a component or sub-assembly along a specific trajectory, and possibly joins two components or sub-assemblies. All the combinations of assembly operations are not geometrically feasible. Geometric feasibility depends on the order of assembly operations owing to physical and geometric constraints of the assembly. A problem encountered in ASP is that a larger number of components will cause more constraints to assembly a product, thus increasing the complexity of assembly problem. Therefore, it has been an objective to look for suitable methods for the solution space of feasible solutions.One of the most promising method for this problem is planning based on the AND/OR net representation. In this study, Petri Nets is proposed to model the assembly sequence problem. Modeling the assembly network by using the Petri Net is mapped from the AND/OR net. The state shift equation of Petri Net, which is a mathematical model of Petri net, is analyzed. Using CPLEX software the mathematical model is formulated as a 0-1 integer linear program that minimizes the total assembly time or cost satisfying assembly operation constraints, such as ease of component handling, ease of component joining, tool changes etc.,

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94. SOME ALGORITHMS FOR PROCESS PLAN SELECTION : Process planning is the systematic determination of the detailed methods by which parts can be manufactured from raw materials to finished products. In real manufacturing environment, usually several different parts need to be manufactured in a single facility sharing constrained resources. Planning of automated systems is known for its high computational complexity. The existence of alternative process plans for each part makes the selection of process plan a very important issue in manufacturing. The process plan selection model reduces the overall number of tools and auxiliary devices, it simplifies the planning problem. The process plan selection might be imprecise and conflicting. Evaluating the most suitable process plan is a very complex task. This project is aimed to develop a mixed integer linear programming model for a process plan selection problem in a Computer Numerical Control (CNC) machining environment to determine the optimal set of process plans by considering the cost factors. The objective function of this optimization problem is to maximize the revenue of the parts. The developed model is solved using CPLEX. Two efficient heuristic algorithms using Excel solver are applied for the selection of a best process plan from a given set of process plans with the objective of minimizing the corresponding manufacturing cost and number of tools and auxiliary devices.

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95. PREDICTION OF QUALITY IN SUBMERGED ARC WELDING USING ANN AND FIS Welding is a process for joining different materials. It is more economical and is a much faster process as compared to both casting and riveting. Because of high quality and reliability, SAW is one of the chief metal joining processes employed in industry. With the proper selection of equipment, SAW can be applied to a wide range of industrial applications. The high quality of welds, the high deposition rates, the deep penetration and the adaptability to automatic operation make the process particularly suitable for fabrication of large weldments. The quality of SAW is mainly influenced by independent variables such as welding current, voltage, travel speed and

electrode stickout.The automation of SAW applications is often desirable due to the somewhat unpleasant working conditions that the process creates. If implemented, automation can increase productivity and weld quality.Artificial Neural Networks (ANN) and Fuzzy Inference Systems (FIS) have attracted the growing interest of researchers in various scientific and engineering areas due to the growing need of adaptive intelligent systems to solve the real world problems. A neural network learns from scratch by adjusting the interconnections between layers. Fuzzy inference system is a popular computing framework based on the concept of fuzzy set theory, fuzzy if-then rules, and fuzzy reasoning.The aim of the project is to predict the weld quality in submerged arc welding process using Neural Network and fuzzy logic. The data set for the process parameters and weld parameters are obtained from experiments. This data set is used to train the neural network. The trained neural network system can provide a set of welding parameters quickly according to the results of the predicted quality measures. Similarly fuzzy model is developed using the experimental data. Fuzzy logic system is based on rules and each of the rules depends on resolving the inputs into a number of different fuzzy linguistic sets. Finally comparison between measured and predicted values of weld quality for SAW is obtained by Simulink.

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96. MULTICRITERIA DECISION MAKING APPROACH FOR SUPPLIER SELECTION AND EVALUATION Supplier selection process is one of the most important components of production and logistics management for many companies. Selection of a wrong supplier could be enough to upset the company's financial and operational position. Selecting the right suppliers significantly reduces purchasing costs, improves competitiveness in the market and enhances end user satisfaction. The selecting process mainly involves evaluation of different alternative suppliers based on different criteria. This process is essentially considered as a multiple criteria decision- making (MCDM) problem which is affected by different tangible and intangiblecriteria. Supplier evaluation and selection problem has been studied extensively. Various decision making approaches have been proposed to tackle the problem. In contemporary supply chain management, the performance of potential suppliers is evaluated against multiple criteria rather than considering a single factor-cost.A concurrent engineering approach integrating analytic hierarchy process (AHP) with quality function deployment (QFD) has been delineated to rank and sub- sequently select candidate-suppliers under multiple, conflicting-in-nature criteria environment within a value-chain framework. Engineering requirements and customer requirements governing the selection decision have been identified. The proposed methodology is unique in the sense that an OR approach has been associated with QFD so as to hear the voice of the customers in a supply chain scenario. The hierarchical QFD methodology allows the decision maker (DM) to rank the candidate- suppliers considering both cost factor and the subjective factors. The proposed methodology allows the purchaser to segregate the criteria according to the problem needs. The devised methodology has been tested with the dataset adopted from Yahya and Kingsman. Liu and Hai tested their model with the same dataset.

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97. PROCESS PLAN SELECTION USING PETRI NETS In part machining, process planning is the act of preparing detailed machining operation instructions to transform an engineering design to a final functional product. The primary goal of process planning is to generate a sequence of operations, called a process plan, describing the manufacturing process of a predefined part. Most of the jobs have a large number of flexible process plans. One process plan for each part needs to be selected with considering shop factors such as production volume, processing time, machine capacity and transportation time.

Any fixed sequence of the operations that is generated in a process plan cannot be the best possible sequence for all the production periods or for the criteria such as quality and machine utilization. Thus the aim should be to generate a process plan with feasible operation sequences for the prevailing production environment. Because of its impact on the performance of a manufacturing system, several researchers have addressed the process plan selection problem. Solving the process plan selection model improves the efficiency of manufacturing resources and brings scheduling flexibility. This project is aimed to develop a Petri net model for process plan selection problem to determine the optimal process plans. A 0-1 integer linear programming model is formulated from the Petri net graph with the objective function of minimizing the processing time of the operations satisfying the operation sequencing constraints and is solved for optimality using CPLEX software. A process plan Petri net model is developed for a given problem and its several properties were analyzed using a Petri net analysis software PIPE.

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98. DESIGN AND ANALYSIS OF HEAT EXCHANGER USING CFD Computational fluid dynamic(CFD) is useful tool in solving and analyzing problems that involve fluid flows, while shell and tube heat exchangers is the most common type of heat exchanger and widely used in oil refinery and thermal power plants because it suit for high pressure application. The processes in solving the simulation consist of modeling and meshing the basic geometry of shell and tube heat exchangers using the CFD package gambit 2.4. Then, the boundary condition will set before been simulate in fluent 6.3. Shell and tube heat exchanger made up of stainless steel is adopted to determine heat transfer coefficient at various flow rates and temperatures. The CFD analysis is performed on shell and tube heat exchanger using fluent. The shell side and tube side heat transfer coefficient for heat exchanger increases with increase in flow rate.

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99. MODELING THE HEAT EXCHANGER PARAMETERS USING ARTIFICIAL NEURAL NETWORKS A heat exchanger is a heat-transfer device that is used for transfer of internal thermal energy between two or more fluids available at different temperatures. In most heat exchangers, the fluids are separated by a heat-transfer surface, and ideally they do not mix. Heat exchangers are used in the process, power, petroleum, transportation, air conditioning, refrigeration, cryogenic, heat recovery. The shell and tube heat exchanger is the most common type of heat exchanger and widely use in oil refinery and thermal power plants because it suite for high pressure application.. Shell-and tube heat exchanger made of stainless steel is adopted to determine heat transfer coefficient at various flow rates and temperatures. The study attempts to show that using the neural network predictive (NNP) structure for control of thermal processes can lead to energy savings. The Neural Network is constructed, trained for set of data's and tested for different data set. The heat exchanger parameters prediction, neural network is validated. The experimental data is given as input to the NN and the output is compared with the actual experimental data. Prediction of the initial heat exchanger parameters is the main aim of the neural network.

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100. "WELD_PRO": A KNOWLEDGE BASED SYSTEM FOR WELDING PROCESS SELECTION Welding is a materials joining process in which two or more parts are coalesced at their contacting surfaces by a suitable application of heat and/or pressure. In today technology, welding is an important process in manufacture and assembly project. There is a need for welding expertise to get the best welding qualities. For small and medium industry, employing a welding expert is quite costly. Metal welding process selection calls for extensive know-how which deals with a huge amount of knowledge. Hence, automation of knowledge through a

knowledge-based system will greatly enhance the decision-making process.Knowledge based systems are artificial intelligent tools working in a narrow domain to provide intelligent decisions with justification. Knowledge is acquired and represented using various knowledge representation techniques rules, frames and scripts. Knowledge-based systems are systems based on the methods and techniques of Artificial Intelligence. The aim of the project is to develop a knowledge-base system for identifying the most appropriate welding processes to suit specific circumstances. Here, 30 welding processes of industrial importance have been incorporated into the system. In this study, only the product type and some of the process capabilities, namely material type, material thickness, method of use, quality level, joint type and welding position, are used to determine the best selection among competitive welding processes.

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101. AN INTEGRATED MODEL FOR SUPPLIER SELECTION AND EVALUATION Supplier selection process is one of the most important components of production and logistics management for many companies. Selection of a wrong supplier could be enough to upset the company's financial and operational position. Selecting the right suppliers significantly reduces purchasing costs, improves competitiveness in the market and enhances end user satisfaction. The selecting process mainly involves evaluation of different alternative suppliers based on different criteria. This process is essentially considered as a multiple criteria decision-making (MCDM) problem which is affected by different tangible and intangible criteria. Supplier evaluation and selection problem has been studied extensively. Various decision making approaches have been proposed to tackle the problem. In this project work, an integrated method of Taguchi loss function, analytical hierarchy process (AHP) and multi-choice goal programming (MCGP) model is proposed to solve the supplier selection problems. First, the Taguchi loss function is applied to assess the loss of each selection criteria. Second, AHP is used to calculate the relative weight of each criterion. Finally, based on the tangible and intangible constrains regarding the suppliers, a MCGP model is formulated and solved to identify the best supplier. The advantage of this proposed method is that it allows decision makers to set multiple aspiration levels for the decision criteria. A numerical example of application is presented and solved using ILOG CPLEX.

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102. ASSEMBLY SEQUENCING AND LINE BALANCING USING PETRI NETS Assembly sequence planning (ASP) aims to identify and evaluate the different ways to construct a mechanical object from its component parts. In the last work, Petri Net is proposed to model the assembly sequence problem and the assembly sequence has been found out from the mathematical model using CPLEX software. This workemphasizes on the analysis of assembly Petri nets. Petri nets are graphical and mathematical modeling tool applicable to many Systems. They are a promising tool for describing and studying assembly systems that are characterized as being concurrent, asynchronous, distributed, parallel, nondeterministic, and/or stochastic. Petri nets are powerful formalism for modeling and analyzing a wide range of dynamic systems and system behaviors. This work shows the structure of reachability graphs of Petri nets and advantages for analyzing the properties of Petri nets. This thesis also presents the assembly line balancing using Petri nets and heuristic. Assembly Line production is one of the widely used basic principles in production system. The problem of Assembly Line Balancing deals with the distribution of activities among the workstations so that there will be maximum utilization of human resources and facilities without disturbing the work sequence. An assembly line is a sequence of workstations, which is used to assemble components into a final product. The economic importance of assembly as a manufacturing process has led to extensive efforts for designing an assembly line to ensure efficiency and cost effectiveness of assembly operations. These efficiency and

effectiveness are maximized by minimizing balancing loss and system loss. The current work offers Petri nets for finding out the assembly sequence and describes heuristic for identifying workstations to assemble components and minimizing balancing loss and system loss. One example has been worked out to indicate the strength of the suggested method.

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103 **An integrated model for knowledge based product lifecycle management** Product Lifecycle Management (PLM) is the activity of managing a company's products across the complete lifecycle, from the early stages of conception to the final disposal or recycling of a product. From this definition, a strong interrelation between the value creation process and the PLM of the company can be deduced. Taking the current globally changing business environment into account the PLM can be considered as a strategic weapon for enabling the company to provide an additional value to customers and thereby gain a competitive advantage over their competitors. Product lifecycle management (PLM) has been accepted by both the academia and industrial alike as fundamental to the product development process in such manufacturing environment. As a strategic approach, PLM applies a set of business solutions in support of an integrated product design, realization, resource utilization, and supply chain management Even though the PLM have huge potential in managing the lifecycle of a product, it resources are not utilized. The major use of PLM is restricted only to the design phase, concentrating on the time to market. This paper deals with development of an integrated model of PLM in all the stages of product lifecycle. The paper also discuss about integrating Knowledge based system to the developed model to usefully maintain and manage data flowing through the system

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104 Flexibility as a performance measure In supply chain using simulation In today's global scenario of intense competition and environmental uncertainty flexibility in supply chain has an important role to play for the existence of any supply chain business. A need to be responsive to the constantly changing market scenario and cater to the customer needs, a certain degree of flexibility is required, which requires the coordination of many plants to produce and deliver goods to customers located in different places, and suppliers, which provide each plant with the required components. This paper intends to measure the degree of flexibility required for a two stage supply chain and assessing both the supplier flexibility and the assembler flexibility. In this study, nine configurations of the SC are considered resulting from the combination of the three degrees of supplier and manufacturer flexibility, i.e. no flexibility, limited flexibility and total flexibility, respectively. Simulation model representing the different flexibility configurations are evaluated and the performance of each configuration analyzed to determine the flexibility configuration suitable to a supply chain. In particular the performance analysis of lead time, work-in-process, service level and cost are measured to determine the suitable flexibility.

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105 An integrated approach for Performance measurement in Maintenance Increased global competition drives the manufacturing firms on concentrate on maintenance management and the performance measurement of maintenance management becomes critical in business success. The measurement of performance is required to be made to identify the gap between the current performance and the targeted performance so that the improvement steps can be taken to bridge the gap. In the present scenario, the performance measurement models are framed for specific maintenance strategies, not covering the maintenance management as a whole. Also the performance indicators for developing specific models are selected at random irrespective of the type of the industry. The objective of this study is to develop an integrated approach to measure the maintenance performance in an industry. This

work integrated the methodologies of Quality Function Deployment (QFD) and Balanced Scorecard (BSC) to ensure that the maintenance performance measurement meets the needs of employees, share holders and customers. This integrated approach is constructed by two stages. In the first stage, a QFD exercise is adopted using "House of quality" diagrams forming a sequence that gradually translate customer requirements into Key performance indicators (KPI) for evaluating the maintenance. In the second stage, the key performance indicators are evaluated through balanced scorecard and the total maintenance performance is arrived.

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106 A dynamic decision support system for new Product Development New product development (NPD) is the term used to describe the complete process of bringing a new product to market. There are two parallel paths involved in the NPD process: one involves the idea generation, product design and detail engineering; the other involves market research and marketing analysis. Companies typically see new product development as the first stage in generating and commercializing new products within the overall strategic process of product life cycle management used to maintain or grow their market share. As a result market driven product design and development has become a popular topic for research studies. But past researchneither covers all of the major influencing factors that drive customers to make purchasing decision. The study proposes a decision support system to predict customer purchasing behavior. A dynamic simulation method called system dynamics is used for the formulation of the model. This will help the decision makers to compare alternatives and select competitive products to launch on the market, but also improves the understanding of customer behavior toward particular products for the formulation of effective product lifecycle management strategies.

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107 Measuring responsiveness of supply chain using simulation: The responsiveness of supply chains to changing market requirements is an important issue in supply chain design and management and therefore currently receives wide attention in the scientific community as well as in practice. Responsiveness can be defined as the ability to react purposefully and within an appropriate time-scale to customer demand or changes in the marketplace, to bring about or maintain competitive advantage. In today's global scenario of intense competition shorter product lifecycles, increased customer expectations, fluctuating inventory levels, mass customisation and changing costs most companies understand the need for supply chain responsiveness, but few recognize the impact of that strategy on their supply chain, nor the shifts they will need to make to move from simply being efficient and to becoming truly responsive. This study is conducted to understand the effect of different manufacturing policies and distribution network policies that have a significant impact on the responsiveness of a supply chain with the help of simulation. In particular the performance analysis of lead time, service level, WIP and inventory level are measured to evaluate the responsiveness of a supply chain.

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108 Measuring the influence of human factor in maintenance The difference between a good and an excellent organization is not only found in technology but also in the empowerment of human capital. Although technology is increasingly replacing men in production organizations, they still need the presence of operators to manage and maintain their machines. This dependence involves humans associated with a constant source of potential error that must be minimized. The human factor in the maintenance function is an essential factor involved in the performance of maintenance department. Despite technological improvements in the conservation of machines, the human element remains essential to the quality of the work performed. Measuring the influence of human factor also increases the effectiveness and efficiency of maintenance department. The objective of the study is to propose a model which can effectively measure the influence of human factor in maintenance

and also to identify the areas which need further improvement. 360 degree assessment method is used to formulate the model for measuring the performance of human factor in maintenance. The proposed model collects data from the entire sources which can be used to assess the performance and thus overcomes the limitations of the existing method.

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109 Maintenance Scheduling for Power Systems Maintenance Scheduling is the level of maintenance that requires planning, allocation of significant amount of time, and high degree of coordination between different departments, and is typically initiated through a work order. All types of systems, from conveyors to cars to overhead cranes, have prescribed maintenance schedules set forth by the manufacturer that aim to reduce the risk of system failure. The problem is to find the best sequence of maintenance actions for each component in the system in each period over a planning horizon such that overall costs are minimized subject to a constraint on reliability or the reliability of the system is maximized subject to a constraint on budget. Maintenance scheduling discussed in my project determines maintenance periods of power units so that a certain level of net reserve is retained. Apart from that, also getting the sequence of maintenance units needed in a particular interval. In this project use of C programming is employed for getting the reasonable results.

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110 Customization of Material Requirement Planning (MRP) Module in SAP Due to the requirement to implement projects successfully within increasingly shorter periods and under continuously rising costs, project management methods and tools like Enterprise resource planning(ERP) are becoming more important in the industry, as well as in the public service sector. The various projects range from smaller cost and investment projects to development or plant maintenance projects to large-scale projects in plant engineering, construction, and mechanical engineering. ERP systems are highly complex information systems. The implementation of these systems is a difficult and high cost proposition that places tremendous demands on corporate time and resources. Many ERP implementations have been classified as failures because they did not achieve predetermined corporate goals. Present day Material requirement planning (MRP) Module in ERP do not perform well in Engineer-to-order (ETO) and Make-to-order (MTO) environments. A study of the material planning activities in an ETO company (BHEL Trichy) is done and a new module for MRP is integrated into ERP for Pipes and Tubes material planning. The before and after implementation scenario of MRP module is analysed and compared New features of the module allows better coordination of activities in the areas of engineering, material acquisition, production, and delivery. The new module especially addresses the problem of planning with uncertain information like forecast bias, demand uncertainty etc., which is characteristic of an ETO environment

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111 Machinability Studies of Inconel 718 and Al 5052 Non-traditional machining has grown out of the need to machine exotic engineering metallic materials, composite materials and high tech ceramics having good mechanical properties and thermal characteristics as well as sufficient electrical conductivity. Electrochemical Machining developed in late 1950's has been accepted worldwide as a standard process in manufacturing and is capable of machining geometrically complex or hard material components, that are precise and difficult-to-machine such as heat treated tool steels, composites, super alloys, ceramics, carbides, heat resistant steels etc. being widely used in die and mold making industries, aerospace, aeronautics and nuclear industries. The principle of anodic dissolution of metal theory is the most accepted mathematical model for evaluating material removal from electrodes during electrochemical process. If two suitable metal poles are placed in a conducting electrolyte and a direct current passed

through them, the metal on the positive pole get depleted and its material is deposited on the negative pole. Keeping this in view, the present work has been undertaken to finding the material removal rate by electrochemical dissolution of an anodically polarized work piece with a tubular copper electrode. In the experiment, INCONEL 718 and AL 5052 are used as specimen. Experiments were carried out to study the influence of machining parameters such as feed rate, applied voltage, conductivity and flow rate on the MRR and overcut in shaping the hole.

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112 **ECM Process Optimization Using D.O.E and Multiple Regression Analysis** Electrochemical machining (ECM) has established itself as one of the major alternatives to conventional methods for machining hard materials and complex contours without the residual stresses and tool wear. ECM has extensive application in automotive, petroleum, aerospace, textile, medical and electronic industries. Studies on Material Removal Rate (MRR) are of utmost importance in ECM, since it is one of the determining factors in the process decisions. So the aim of present work is to investigate the MRR and overcut of Inconel 718 and Al 5052 work pieces by using a copper tube tool. Three parameters were chosen as process variables: Feed rate, Electrolyte flow and Electrolyte concentration.The result of experiment shows that relationship between process variables and responses.Grey relation grade (GRD) was also applied to identify the optimal parameter setting in the experiment. .

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113 TPM implementation Case Study Primary goal of TPM (Total Productive Maintenance) is to change the culture of the company maintenance policy by participating all employees towards maintenance systems of the company. It aims to reduce unplanned stoppage, breakdowns, accidents and losses obstructing equipment effectiveness. In most of industries maintenance is considered as evil activity. Therefore by implementing TPM the industries can increase their equipment effectiveness and productivity. This project work is aimed to implementation of Total productive maintenance in heavy engineering industries. Total productive maintenance is a methodology that aims to increase the availability of existing equipment hence reducing the need for further capital investment. Total Productive Maintenance (TPM) is the enabling tool to maximize the effectiveness of equipment bysetting and maintaining the optimum relationship between people and their machines.Overall Equipment Effectiveness (OEE) is used as a measure when evaluating the result of TPM. Measurement of OEE at Power Plant Piping Unit (PPPU), BHEL, Tirumayam for two important machines identified by the management namely Pipe chamfering machine and Vertical turning centre before and after implementation of TPM.

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114 Customization of MRP Module in ERP Due to the requirement to implement projects successfully within increasingly shorter periods and under continuously rising costs, project management methods and tools like Enterprise resource planning(ERP) are becoming more important in the industry, as well as in the public service sector. Manufacturing businesses depends on a well-coordinated chain of events to make their operations work effectively. The search for, increased industrial productivity, better customer service, and improved inventory accuracy, enhancement of buyer/seller communication, effective man power allocation, automated process planning and higher quality standards is generating new opportunities and challenges for bar codes as a means to support complete Manufacturing Resource Planning (MRP II) and supply chains. A study of the process planning, production planning and resource allocation activities in an ETO company (BHEL Trichy) is done and a new module for incorporating Barcode Technology into MRP II system of SAP is developed. New features of the module allow automatic generation of Operation Process Sheet with unique barcode. Distribution and allocation of job will be very effective. Tracking of the job is easy. Hour’s analysis can be done and productivity of individual can be

analysed. New System improves operational efficiency, saves time, reduce errors and cut down costs.

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115 Investigations on Process Characteristics of ECM Electrochemical machining is widely used non-traditional machining process used to machine hard to cut material irrespective of their hardness and also used to make complex profiles and blind holes. It is mainly used by automotive, offshore petroleum industry, medical application and aerospace industry as its principal user. Titanium alloy Ti6Al4v is most worked material owing to its hardness, and higher machining and tooling cost. It is primarily used in aircraft turbine blades, heat exchangers and shafts in marine application. Taguchi design was employed to plan the experiments. Relationship between influencing parameters like feed rate, flow rate, electrolyte concentration and output responses like MRR and OC were studied. ANOVA was used to find out the most significant parameter. Also, process capability study was done and process capability indices were found for the different material. In the end it has been concluded that machine is capable enough or not and some recommendation have been suggested to improve the capability of the machine.

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116 Predictive Neural Networks for ECM Process The important performance parameters such as material removal rate (MRR) and overcut (OC) are influenced by various machining parameters namely electrolyte concentration, feed rate of electrode and electrolyte flow rate in electrochemical machining process (ECM). In machining, the process of modelling and optimization are challenging tasks to qualify the requirements in order to produce high quality of products. There are a lot of modelling techniques that have been discovered by researchers. In this present work, the optimize settings of performance parameters; OC and MRR are done by the Taguchi technique and the experimental result of MRR and OC was predicted by the Multi- layer Feed forward Neural network (MFNN). For Taguchi analysis, three process parameters and two responses MRR and OC were considered by L9 orthogonal array design. Inconel 718, Al 5052 materials were used as the work piece for the experiments. After evaluating MFNN, the predicted values were found. Then predicted values compared with experimental values to find out error.MFNN gave less than 10% prediction error.

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117 Total Productive Maintenance Over the last decades, Total Productive Maintenance has become key concept for improving production. The focus of the TPM is on the human resources. Primary goal of Total Productive Maintenance is to change the culture of the company maintenance policy by involving all employees towards maintenance systems of the company. Total productive maintenance has been promoted for its simplicity and its benefits to the maintenance delivery system. This study is aimed to implementation of concepts of TPM for the management hence called as Total Productive Management. Generally TPM activities focused on operator level. The defects occurred due to poor management doesn't take in account. So a new approach is made by taking the activities of management which directly affect the operator/machine availability and reduced the productivity of machine. By this the Overall Equipment Effectiveness of management will be calculate and improvement will be suggested. For this purpose the practical approach is selected. The TPM is implemented in Public Sector heavy engineering works industry situated in Tamilnadu.

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118 Field Services Management. The field services are nowadays acknowledged as a relevant source of revenue, profit and competitive advantage in most manufacturing industries. Field services are basically related to the providing better after sales services so that the customers can be retained. Many industries, national and

multinational companies set as their first priority “customer satisfaction”, as they know that only this way they can maintain or increase their market share. There are various classes of customer, depending on their contract with the company. Resource allocation is one of the promising problems in FSM. In resource allocation one of the problems the managers face is how to allocate field service technician to the highest priority customer to maintain the loyalty of that customer. The quality of a field service technician allocation decision is largely dependent on the qualifications, experiences, performance, behavior, skills, service time and many other qualitative and quantitative factors of the allocated technician. This study proposes a fuzzy hybrid MCDM (Multi Criteria decision making) technique to rank the field service technicians. The Analytical Hierarchical Process (AHP: to determine the relative weights of the evaluation criteria) and Technique for Order Preference by Similarity to Ideal Solution (FTOPSIS: to rank the alternative technicians) is applied to evaluate the best adequate technician dealing with the rating of both qualitative and quantitative criteria involved in field services and from the result of FTOPSIS top five technicians are taken and Fuzzy Preference Ranking Organization Method for Enrichment Evaluation II (FPROMETHEE II) is used for final ranking. Hence this study provides a way to rank the technicians in a field service environment. So we can find out the best technician and allocate that technician to the highest priority customer to maintain the loyalty of that customer.

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119 Electrochemical machining of titanium alloy (ti-6al-4v). This work details about the investigation on the influencing operating parameters of electrochemical machining of titanium alloy. Titanium alloys combine outstanding mechanical properties with corrosion resistance and biocompatibility. The machinability of titanium alloys is generally poor and component manufacturing is costly. Electrochemical machining (ECM) has established itself as one of the major alternatives to conventional methods for machining difficult-to-machine materials such as Ti-alloys. Nontraditional machining processes are explored for most of the industrial applications. Electrochemical machining (ECM) is one of the promising techniques for a stress free, non-contact material removal process with better precision control. The performance characteristic of the processes, namely material removal rate (MRR), overcut (OC), depends on the process parameters and are considered as the responses for this process. Taguchi’s orthogonal array, the analysis of variance (ANOVA) and grey relation analysis (GRA) are employed to analyze the effect of these parameters and to find the optimal process parameters levels.

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120 performance measurement system for a maintenance function. The performance and competitiveness of manufacturing companies is dependent on the reliability, availability and productivity of their production facilities. To ensure the desired performance, maintenance managers need a good track of performance on maintenance process and maintenance results. This can be attained through development and implementation of a rigorously defined performance measurement framework and indicators that are able to measure important elements of maintenance function performance.Many maintenance performance measurement (MPM) frameworks and indicators (MPI) are presented in literature; however some major issues remain unresolved. Many papers discuss the development of generic maintenance performance frameworks and corresponding indicators; however none of the publications considers the selection of relevant MPI for a specific business context and consequently in relation with the company’s maintenance objectives. The purpose of the study is to develop an MPM framework that aligns the maintenance objectives on all management levels with the relevant MPI used. In order to assist the maintenance manager on selection of the relevant MPI, an analytic network process (ANP) model and methodology is presented which is based on the designed MPM framework. The methodology is applied as a case study in the a public sector heavy engineering work industry situated in Tamilnadu.

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121 Selection of service technicians in field service management. Field Service Management (FSM) is basically related after sales services. After Sales Services are customer support following the purchase of a product or service formalized by a warranty or service agreement between service provider and the customer. There is always requirement of providing after sales services to make the customers happy and to retain the customers. Nowadays field services are acknowledged as a relevant source of revenue, profit and competitive advantage in most manufacturing industries. Resource allocation is one of the promising problems in FSM. Selection and assignment of service technicians to the service faults is very complex in nature, because lot of factors are involved in assignment of technicians like current location of technician, experience, skills, part time or full time etc. One of the problems the resource planner face in field services is how to select the field service technician with the required skill/skills, at the required time, distance between the source (current location) and the destination, transportation mode etc. This study proposes a Model for selection of technician to the service faults using Excel VBA by considering required skills of technicians and the longitude and latitude current location of technicians and longitude and latitude of the destination to find out the distance between source and destination. Hence this study provides a way to select the technicians to the service faults with required skills, at the required time with distance between the source (current location) and the destination and transportation mode. The major advantage of this model is the speed of selection: model selection is clearly faster than that done by a person, however expert.

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122 Process characteristics of electrochemical machining of Incoloy 800HT. This work details about the investigation on the influencing operating parameters of electrochemical machining of Incoloy 800HT. It is a high-strength, corrosion-resistant nickel-iron-chromium material used at 1200° to 1600°F. Incoloy 800HT is used extensively in aerospace, such as jet engine and airframe components, power plants, industrial furnace, pressure vessels, chemical and petrochemical processing, hydrocarbon cracking and in quench boilers because of their excellent combination of high specific strength and their exceptional resistance to corrosion at elevated temperature, high creep rupture strength and resistance to oxidation and carburization at very high temperature. Electrochemical machining (ECM) has established itself as one of the major alternatives to conventional methods for machining difficult-to- machine materials such as nickel-iron-chromium alloys. Nontraditional machining processes are explored for most of the industrial applications. Electrochemical machining (ECM) is one of the promising techniques for a stress free, non-contact material removal process with better precision control. The performance characteristic of the processes, namely material removal rate (MRR), overcut (OC), depends on the process parameters and are considered as the responses for this process. Taguchi's orthogonal array, the analysis of variance (ANOVA) and grey relation analysis (GRA) are employed to analyze the effect of these parameters and to find the optimal process parameters levels.

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123 Implementation of sustainable manufacturing tools. In general product design and development process, only economical benefits have been considered but the effectiveness of the environment or society has not been considered. The worldwide appreciation for sustainable development through laws forces organizations to rely on a development based on sustainable growth. Thus, the responsibility of the manufacturer should be focused on successful product design and development process in order to avoid or minimize harmful or bad ecological social and economical effects. For such development, proper implementation of sustainable manufacturing tools becomes inseparable. A case study has been conducted on

Coimbatore based Electronics Company with proper implementation of sustainable manufacturing tools. These tools involve sustainable decision making tools like Quality function deployment for Environment (QFDE) and sustainability tools like Emergy analysis and Embodied product energy analysis. Though Emergy analysis is often solely used as an assessment tool, it is applied along with decision making tool like QFDE. Emergy analysis and Embodied product energy analysis are used to assess energy consumption level for critical component parts and possible options for sustainable manufacturing are arrived upon. This implementation of sustainable manufacturing tools proved reliable and improved participation in decision making.

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124 **Facility layout optimization using linear and non-linear mixed integer programming.** The block layout problem of a multi-objective facility layout is an important sub class of the facility layout problem with practical applications when the price of land is high or when a compact building allows for more efficient control. Every department and shop floor in tested problem were fixed dimension of length and width. Proposed model considered a facility layout problem where size andlocation of each department, overall length and width of facility are all modeled as decision variables. The formulation is large mixed integer programming problems. Model considered two objective functions, minimizing material handling cost and facility building cost and proposed a lexicographic technique to handle multiple objectives. The results of the numerical experiments are showed by solving these problems with MIP solver for the base formulation and acceleration techniques such as symmetry breaking constraints to reduce the computation time and approximation to linearize constraints of area of each department

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125 **Field service scheduling using mixed integer programming**. Field Service Management (FSM) most commonly refers to companies who need to manage installs, service or repairs of systems or equipment at customer's sites. FSM comprised of forecasting, planning and optimization, execution, control and continuous improvement. This paper focus on planning & optimization phase of the field services value chain. In real word, resource planners are finding difficulty in allocating the right resource to the right scope due to lack of visibility in to their availability, skills and location for a given period. Due to multi-criteria involved in decision making under a dynamic and uncertain field service environment there is a need to develop a system to resource planners to identify the right resource in short span. Minimal was has done in this area through exploiting the heuristics, traditional techniques as well as knowledge based analysis, this paper propose a mathematical model for field service scheduling problem to assist the decision makers for resource selection and preparing schedules. Here we are formulating FSSP as a mixed integer programming (MIP) model with constraints. This model is validated with an example and found competent.

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126 **Maintenance strategies selction using fuzzy FMEA and integer programming.** In recent years, there is a growing concern on the subject of higher maintenance cost and maintenance productivity. Maintenance cost is one of the main components of any firm's operational expenditure. Hence efficient and effective maintenance system plays a key role in achieving organizational goals and objectives.This work proposes integer linear programming approach for maintenance strategies selection using fuzzy FMEA. Integer programming approach is a more quantitative framework than the classic RCM approach which assigns to each failure mode (determined using FMEA) the best maintenance policy, taking into account the cost of each strategy, the compatibility constraint between failures and policies, and the available monetary

resources, in order to maximize the potential reduction in Risk Priority Number (RPN) of corresponding failure. The evaluation of RPN in traditional FMEA is just a product of three parameters viz. Severity, frequency of occurrence and chance of non-detection. Because of subjective and qualitative nature of information and to make analysis more consistent and logical, a fuzzy linguistic model is proposed. In the proposed approach, these parameters are represented as members of a fuzzy set fuzzified by using appropriate membership functions and are evaluated in fuzzy inference engine, which makes use of well-defined rule base and fuzzy logic operations to determine the criticality/riskiness level of the failure. The fuzzy conclusion is then defuzzified to get risk priority number. This improved RPN is then used in integer programming model to obtain optimal maintenance strategies.

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127 **Decision making on call performance using statistical analysis software**

The essential part of a consumer lending business is collections, whereas acquiring new customers and maintaining them requires substantial planning, and is expected to result in good business performance, the important factor for efficient collection is to maintain balance between the effectiveness of treatments against the cost incurred. Call center provides effective strategy of collections, but improving the call center performance by maintaining the service level is very important. Increase in abandoned rate of calls can lead to financial loss in millions of dollars for consumer lending business. Service level can be improved by reduction in ASA (Average speed of answer), AHT (Average handling time) and Abandoned rate of calls. Arrival rate of calls in a call center is unpredictable so, routing of calls by implementing the different algorithm, depending on the available technology can lead us to a good service level. To convert the routing of calls from percent allocation to dynamic based routing which works as per the availability of agent. The dynamic routing implemented using the new technology and algorithm is assessed by extracting the call stats using SAS (Statistical Analysis software) and it showed a significant improvement in performance of a call center with same number of available agents.

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128 **Multiperiod field service scheduling using mixed integer non linear programming.**

Field Service Management (FSM) is basically related to after sales services. After Sales Services are customer support following the purchase of a product or service formalized by a warranty or service agreement between service provider and the customer. After-sales service in firms manufacturing and selling durable goods has a strategic relevance in its potential contribution to company profitability, customer retention and product development. There is always requirement of providing after sales services to make the customers happy and to retain the customers. Nowadays field services are acknowledged as a relevant source of revenue, profit and competitive advantage in most manufacturing industries. FSM comprised of forecasting, planning and optimization, execution, control and continuous improvement. This paper focus on planning & optimization phase of the field services value chain. In real word, resource planners are finding difficulty in allocating the right resource to the right scope due to lack of visibility in to their availability, skills and location for a given period. Due to multi-criteria involved in decision making under a dynamic and uncertain field service environment there is a need to develop a system to resource planners to plan a right schedule for jobs. Minimal was has done in this area through exploiting the heuristics, traditional techniques as well as knowledge based analysis, this paper propose a mathematical model for multi period field service scheduling problem to assist the decision makers for resource selection and preparing schedules. Here we are formulating FSSP as a mixed integer non- linear programming (MINLP) model with constraints. This model is validated with an example and found competent.

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129 **Fault diagnosis using case based reasoning.** Rotating machineries are widely used in industries and is a major part of any company's productive assets. Therefore when a fault occurs it needs to be identified for possible causes and conduct remedial action immediately. In this project the problem of fault diagnosis of rotary machines wastackled using Case Based Reasoning (CBR). Objective was to develop an intelligent diagnostic system which will automate the expert's diagnostic reasoning. For complex systems like rotary machines, causality between the symptom and a root cause is difficult to establish. Hence classical model-based diagnostic techniques are found to be inadequate for the current problem. Case-based reasoning (CBR) is a new artificial intelligent methodology that uses implicit knowledge from previous experience to guide the new problem solving. Therefore CBR is more suitable for the problem at hand. We have developed a prototypical CBR system using myCBR software tool. First we developed case representation for organizing and retaining the knowledge contained in each case which is relevant for fault diagnosis. Then a case base of twenty cases was developed from published work. Then similarity measures for retrieval of cases are defined in consultation with the expert. The developed model was tested on some typical problems. The resolution capability of the system was found satisfactory. The accuracy of the system depends on the richness

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130 **Cost control in a storage installation for petroleum products using DEMATEL**. Petroleum Industry is one of the core industries of Indian Economy. There is a lot of research gap in this field, since the data and information pertaining to the same is not readily available and not accessible to all. Product is despatched to market finally through Storage installations. The operational cost incurred by the storage installations plays a very vital role in the profit of the Oil Marketing Company. Cherlapally Installation of Bharat Petroleum Corporation Limited in Hyderabad is considered for study in this project. The various costs involved in location operations are identified and from those cost factors, 18 cost factors have been identified, which are having high negative impact on the operational cost of the location (Rise of Cost). Later, Decision Making Trial and Evaluation laboratory (DEMATEL) qualitative analysis was used to understand the mutual influences amongst the eighteen cost factors by survey. This study seeks to identify the top three cost factors which are acting as the most dominant factors for rise of Operational Cost of location. Later the measures that need to be taken and the strategies to be followed to reduce these three cost factors are discussed.

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131 **Optimization of downstream supply chain with multiple time periods** Petroleum Industry is one of the core industries of Indian Economy. The petroleum supply chain (PSC) is a very complex network which is vertically integrated, covering activities from exploration to transformation in refineries and product distribution with a large logistic network. Planning activities in the downstream part of the supply chain of petroleum sector involve both strategic and tactical decisions. Strategic decisions include determining the location and capacities for distribution centers, while decisions regarding tactical planning involve flow allocation and modes of transportation. The present work mainly focuses on the tactical planning of the supply chain of oil industry. This project proposes a Mixed Integer Linear Programming (MILP) model for optimizing the total cost involved in the production and movement of product from refineries/supply locations to distribution centres. The model is formulated for multiple time periods and scenarios of disruptions/shut down of supply locations for a particular time period are also considered. The final model gives the transportation modes and transfer volumes by which the whole supply chain is modeled in a cost efficient manner. The developed MILP problem was modeled in GAMS and

applied to a real case study of the supply chain network of Southern Region of an Indian Oil Company. The formulated model in GAMS is solved using CPLEX solver and desired results have been obtained

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132 **Investigation on machinability of superalloy inconel 617**. Super alloys are heat-resistant alloys of nickel, nickel–iron, or cobalt that exhibit a combination of mechanical strength and resistance to surface degradation generally unmatched by other metallic compounds. These Super alloys sustain its strength at high temperature and pressure conditions. Such materials have great demand in aerospace industry, marine industry, and nuclear power plants. It is particularly used in the hot sections like engines, because of their high strength and corrosion resistance at high temperature and pressure but they are the most difficult to machine materials. Their high strength possesses large amount of heat generation while machining, which reduce life of tool. Strain rate sensitivity, work hardening and precipitation hardening of material leads to more tool wear. Surface integrity obtain while machining of super alloys is poor. Poor surface finish and high residual stresses are the main causes of failure of these material components. Superalloys are hard to machine materials and are inherently difficult to process using conventional machining process. Non- traditional machining methods are preferred for the processing of these alloys and abrasive water jet drilling is one of the processes which needs attention. An analysis of drill rate, overcut, taper angle and surface roughness of the drilled holes in abrasive water jet drilling of Inconel 617 has been detailed. The drilling parameters are water jet pressure, standoff distance and abrasive flow volume. Analysis of variance is used to depict the influence of each factor on the responses. Analysis of means is carried out to identify the optimal factors for each of the responses. Further multiple regression analysis is carried to develop a linear relationship between the input and the output. Prediction of responses is done using the developed set of equations.

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133 **New paradigm for inventory management in medium and large scale industries** This report briefly reviews some recent work aimed at inventory management and its problems in today´s competitive world. The study is focused especially on Large and medium-sized Industries with production processes. The goal is to outline the major difficulties influencing the performance of these manufacturing companies in connection with the complexity of their inventory management. Industries are facing difficulties of Large Inventory Capital Management and Stock outs. The Major part includes describing the building of Quantity Based Dispatch Model of Vendor Managed Inventory and implementing it under Stochastic conditions that should positively influence the inventory management and gain some savings in terms of Inventory Cost Holdings. Vendor-managed inventory is a family of business models in which the buyer of a product provides certain information to a supplier (vendor) of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (usually a store). Modelling of Current inventory model and Vendor Managed Inventory model is carried out in Arena Simulation Software And Value of Total Inventory Cost and Inventory level is optimized using optimization OptQuest Tool. Finally, Summary and Contribution of Research is highlighted.

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134 **Life cycle assessment for a process industry.** Life cycle assessment (LCA) methodology is a well-established analytical method to quantify environmental impacts, which has been mainly applied to products. However, recent literature would suggest that it also has the potential as an analysis and design tool for processes, and stresses that one of the biggest challenges of this decade in the field of process systems engineering (PSE) is the development of tools for environmental considerations. This project attempts to give an overview of the integration of LCA methodology in the context of industrial ecology, and focuses on the use of this methodology for

environmental considerations concerning process design and optimization. The project identifies that LCA is often used as a multi-objective optimization of processes. Practitioners use LCA to obtain the inventory and inject the results into the optimization model. It also shows that most of the LCA studies undertaken on process analysis consider the unit processes as black boxes and build the inventory analysis on fixed operating conditions. The project highlights the interest to better assimilate PSE tools with LCA methodology, in order to produce a more detailed analysis. This will allow optimizing the influence of process operating conditions on environmental impacts and including detailed environmental results into process industry. Today's companies have to find a way between focusing on profit on the one hand and also concentrating on other issues like social concerns or environmental issues. This sustainable approach leads to an integrative corporate policy that, in addition to economic aspects, also considers social and environmental concerns. Inventory data is information that can be measured or directly determined and specified (e.g. carbon dioxide emissions). In contrast to the inventory level, impact data has to be calculated or determined on the basis of the inventory data to give information about the contribution of inventory parameters to certain impacts or effects (e.g. global warming potential – GWP). As federal regulations has tightened, companies have come under growing pressure to minimize emissions of waste into air and water. Companies also often want to know whether the raw materials they use might become scarce or be environmentally harmful. Life cycle assessments can provide answers, because the companies' data are reliable and their goals are usually clear

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135 **Selection of maintenance strategy for a process industry.** Industries are greatly dependent on the correct functioning of technical systems and Maintenance of these systems ensures the safety and dependability of technical systems, and to decrease the cost of operation throughout the system's life which helps in achieving organizational goals and objectives. The importance of the maintenance function has increased because of its role in keeping and improving system availability and safety, as well as product quality. Process industry such as hybrid seed processing and packaging, have multiple systems, subsystems and components of mechanical, electrical, electronics and software nature which follow different rates and mode of failure. These features of process industry necessitate a comprehensive maintenance strategy that can reduce the downtime of plants and increase the profit margins. The optimum maintenance strategy ensures the long run of equipment's and reduces the maintenance cost. The selection of optimum maintenance strategy differs from industry to industry based on their mission and vision. The selection of maintenance strategy is a multi-faceted problem with conflicting criteria, such as profit margin and availability of the technical system. The optimum maintenance strategy ensures the long run of equipment's and reduces the maintenance cost. The aim of this project is to reduce the losses incurred by the company due to downtime and increase the profit margin. Each method used for the selection of maintenance strategy has its own strength and weakness and the better results can be obtained by combining two or more. The development and installation of hybrid model for selection of optimum maintenance strategy are the focus of this project. The scope of this project is the determination of the ability of condition monitoring systems to predict the time of occurrence of a failure. The characteristic of the condition monitoring system is termed as its predictability. This project aims to evaluate different maintenance strategies for different equipment. The probable causes of failure and probable remedies of technical systems are identified using Fault Tree analysis, which translates the physical system into a logical diagram. Considering the imprecise judgments of decision makers, the fuzzy is used for the evaluation of different maintenance strategies. For making uniform consensus of the decision makers, we converted all pairwise comparisons into triangular fuzzy numbers to adjust fuzzy rating and fuzzy attributes weight and used fuzzy operators to get to select the best alternative.

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136. **Investigation on profile cutting of Superalloy using non-traditional process** Development of advanced engineering materials, precise design requirement, intricate shape and unusual size and shape of the workpiece restrict the use of conventional machining process. Conventional sheet cutting methods have limitations regarding hardness of sheet material, demand of narrow kerf, complex shapes and intricate profiles. Hence, it was realized that new sheet cutting methods be developed with advanced characteristics known as non-conventional or Advanced Sheet Cutting Methods (ASCMs). Nowadays, many advance sheets cutting methods are being used in industry like Abrasive Jet Cutting (AJC), Water Jet Cutting (WJC), and Abrasive Water Jet Cutting (AWJC) and Laser Beam Cutting (LBC) are the examples of ASCMs. AWJC and LBC are more popular due to their cutting capabilities. The best choice of manufacturing conditions is one of the prime factors that has to be envisaged in the common manufacturing processes, especially, in those associated with Electrical Discharge Machining (EDM) and Wire Electrical Discharge Machining (WEDM). Such a process should be capable of machining geometrically complex or hard material components that are precise and difficult-to-machine such as heat-treated tool steels, composites, super alloys, ceramics, carbides, heat resistant steels etc. That are being widely used in dies and mould-making industries, aerospace, aeronautics and nuclear industries. Machine tool industry has made exponential growth in its manufacturing capabilities in the last decade but still machine tools are not utilized at their full potential. This limitation is a result of the failure to run the machine tools at their optimum operating conditions. The problem of arriving at the optimum levels of the operating parameters has attracted the attention of the researchers and practising engineers for a very long time. Wire-cut electrical discharge machining (WEDM) is one of the most emerging nonconventional manufacturing processes for machining hard to machine materials and intricate shapeswhich are not possible with conventional machining methods. The study of white layer thickness need attention to investigate the machinability of Superalloys to machine with suitable machining requirements. The work is focused on the analysis methods such as ANOVA, MRA and artificial neural network(ANN) to predict the machining responses and finally outlines the recommendations and future trends in WEDM research.

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137. **Life Cycle Assessment for Power Plants** Life cycle assessment (LCA) methodology is a well-established analytical method to quantify environmental impacts, which has been mainly applied to products. However, recent literature would suggest that it also has the potential as an analysis and design tool for processes. Electricity generation is a key contributor to global emissions of greenhouse gases (GHG), NOx and SO_2 and their related environmental impact. The aim of this paper is to provide methods to find the emission source and estimate the amount of waste gas emissions in the electricity coal supply chain, establish the model of the environmental impact (burden), detect the critical factor which causes significant environmental impact, and then identify the key control direction and reduce the amount of environmental pollution in the electricity coal supply chain. The life cycle assessment (LCA) of electricity generation based on hard coal was carried out to identify ranges of emission data for GHG, NOx and SO_2 related to individual technologies. Emission data were evaluated with respect to three life cycle phases (Coal Mining, Coal Preparation, and Coal Burning). Direct emissions from plant operation represented the majority of the life cycle emissions for fossil fuel technologies. These data indicated that all three phases should be included for completeness and to avoid problem shifting. The most critical methodological aspects in relation to LCA studies were identified as follows: definition of the functional unit, the LCA method employed (cradle-to grave method), the emission allocation principle and/or system boundary expansion. The CO_2 emissions accounted for 98.99 wt.% of the total waste gas emissions. The vast majority of CO_2 was emitted

from the coal burning process. Other than CO_2 CH_4, SO_2 & NO_x were other main waste gas emissions. Of the three subsystems examined, transportation process requires the fewest resources and has the lowest waste gas emissions. In the power plant, the biggest environmental impact of waste gas emissions is GWP, followed by EP, AP, POCP & ODP, and the regional impact is greater than the global impact.

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138. **Risk management in service industry** Risk, prevalent in all organizational activities influences the achievement or non- achievement of organizational goals. This necessitates the need for a structured process for effective risk management. Traditionally, risk management strategies were centered on insurance solutions, however due to changes in the business landscape, organizations moved towards an integrated, holistic strategy-focused risk discipline. Service industry owner-managers are however largely ignorant about the risks faced by their enterprises. They still respond reactively to risk by utilizing risk avoidance and risk transfer techniques. These non-structured approaches to risk impede on Service industry growth and success, limiting their role to providing employment, contributing to investment, and contributing to the economy as a whole. In this research study a Service industry risk architecture framework that can be used concurrently with corporate governance frameworks as well as the organization's performance measurement system is proposed resulting in a structured approach to managing Service industry risks. The proposed Service industry architecture framework consists of three interrelated components, namely: Service industry risk consciousness, focusing on risk sources most commonly identified as obstacles to Service industry success and survival. The Service industry risk management process that constitutes the steps Service industry owner-managers should follow in addressing risk sources. The SME risk management framework providing owner-managers with a mechanism to deal with risks at all organizational levels through effective risk planning, risk implementation and risk evaluation processes.

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139. **Time Based Vendor Managed Inventory Systems – An Industrial Case Study**
The current business environment need to address higher customer requirements on delivery times, product innovations and high unpredictable product demands. There is a need for case based inventory management system to address the constraints like varieties of products, batch sizes and target stocks with controlled inventory cost, total cost and stock on hand. Wrong policies result in tie up of working capital, severing customer relationships and ill will among shareholders. Goal behind the process of evaluation and selection of inventory policies is to locate the right policies to deliver quality products in optimum quantity at lower and optimum cost. Vendor-managed inventory is a family of business models in which the buyer of a product provides certain information to a supplier (vendor) of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location. In the 1st phase of project, inventory policy framework was modelled using a package "ARENA". This model draws main lines on the activities like ordering, invoicing, production, inventory etc. related to material and information flow through supply chain. In the 2nd phase of project, case study in large scale industry like BHEL is taken to lead the model in following lines and improve the present hypothetical results into robust inventory management system. Modelling of Vendor-managed inventory model under various dispatch scheme is done and values of total inventory cost and stock on hand is optimized using optimization OptQuest Tool. The activities associated with it which include selection and evaluation of right inventory policies, rating inventory policies performance, determining the optimum lead time, review period and reorder point, sourcing goods and services, timing purchases, selling terms of sale, evaluating the value received, predicting price, services and sometimes demand changes specifying the form in which goods are to be received.

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140 A hybrid model to schedule technicians in field services Field services refers to all the services which are carried out either at the client site or en route it. Field services

majorly involve the installations, service or repairs of systems or equipment at customer's sites. The management of field service resources is a very important task as they are responsible to enhance customer service and loyalty along with company's profitability. Field Service Management (FSM) comprises of forecasting, planning & optimization, execution, control and continuous improvement of the concerned services.

This project is focused on planning & optimization phase of the field services value chain. In real world, resource planners are finding difficulty in allocating the right technician to the right scope due to the lack of visibility in to their availability and skills for a given period. Due to multi-criteria involved in decision making under a dynamic and uncertain field service environment, there is a need to develop a system for resource planners to identify the right resource in short span.

Field service management is a developing field and through exploiting the heuristics, traditional techniques as well as knowledge based analysis, this project proposes a hybrid model for technician scheduling in field services to assist the decision makers for technician selection and preparing schedules. Analytic Hierarchy Process (AHP) has been used to rank the technicians on the basis of various factors like experience, certifications, skills etc. and technician preference indices are obtained. Thereafter a Field Service Scheduling Problem (FSSP) is formulated as a Mixed Integer Non Linear Programming (MINLP) model with constraints. This model has been validated using General Algebraic Modeling System (GAMS) and found competent.

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141 Heat input analysis while welding of S355NL The welding processes that employ an electric arc are the most prevalent in industry. .The Gas metal arc welding and Shielded metal arc welding are used in most of the industries. These processes are associated with molten metal. All arc welding processes employ some means of shielding the molten weld pool from the air. Gas Metal arc welding is high preferred because it offers high production rate, high melting efficiency, easy of automation and low operator skill requirement. The welding parameters are most important factors affecting the quality, productivity & cost of welding.

The project work is focused on the influence of the welding parameters like welding current, welding voltage, welding speed on tensile strength, hardness and residual stresses on structural steel (S355NL).By using DOE method, the parameters can be optimized and having the best combination for target quality. A plan of experiments based on Taguchi technique has been used to acquire data .An orthogonal array and ANOVA (analysis of variance), GRA methods are employed to get optimum parameters. The research aims to identifying the main factors that have significant effect on weld tensile strength, hardness and residual stress and micro structure.

In this study focus is concentrated on heat input calculation based on welding parameter optimization by conducting experimental trails for S355NL material for Shielded metal arc welding and Gas metal arc welding process .Initially SMAW process was done for 3 heat input conditions with input parameters like voltage, current and welding speed then mechanical testing tensile ,hardness, impact and micro tests was performed for these 3 samples .In GMAW process L9 orthogonal array was used for different input parameters like current, voltage, welding speed for different heat input conditions then mechanical testing tensile and hardness ,micro, XRD performed for getting results and ANOVA,GRA optimization technique used for selection of optimum parameters.

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142 Dynamic multi-technician scheduling in field service maintenance Field services refers to all the services which are carried out either at the client site or en route it. Field services majorly involve the installations, service or repairs of systems or equipment at customer's sites. The management of field service resources is a very important task as they are responsible to enhance customer service and loyalty along with company's profitability. Field Service Management (FSM) comprises of forecasting, planning & optimization, execution, control and continuous improvement of the concerned services.

In real world, resource planners are finding difficulty in allocating the right technician to the right scope due to the lack of visibility in to their availability and skills for a given period. The maintenance tasks can be broadly categorized as regular maintenance or emergency maintenance tasks. Static scheduling can take care of the regular maintenance tasks. Emergency breakdowns are dynamic in nature as the tasks have to be reassigned during maintenance. Due to multi-criteria involved in decision making under a dynamic and uncertain field service environment, there is a need to develop a system for resource planners to identify the right resource in short span. This project is focused on planning & optimization phase of the field services value chain. A methodology has been developed to allocate technicians in the static as well as dynamic environment. Also, the goal of this work is to ensure that the model represents the real world situation by incorporating the different locations of the client sites and the transportation costs incurred by the technicians to travel there. The complex situation of a task requiring two or more technicians simultaneously has also been tackled in this project. Field Service Scheduling Problem (FSSP) is formulated as a Mixed Integer Non Linear Programming (MINLP) model with constraints. This model has been validated using General Algebraic Modeling System (GAMS) and found competent.

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143 Investigation on corrosion rate while welding 0f S355NL by GMAW The welding processes that employ an electric arc are the most prevalent in industry. .The Gas metal arc welding is used in most of the industries. These processes are associated with molten metal.. Gas Metal arc welding is high preferred because it offers high production rate, high melting efficiency, easy of automation and low operator skill requirement. The welding parameters are most important factors affecting the quality, productivity & cost of welding. Corrosion plays a vital role when the material is subjected to marine environment.it is important to control the corrosion rate in the fabrication stage that means in the stage welding stage. The project work is focused on the influence of the welding parameters like welding current, welding voltage, welding speed on corrosion of S355NL.By using DOE method, the parameters can be optimized and having the best combination for target quality. A plan of experiments based on Taguchi technique has been used to acquire data ..An orthogonal array GRA methods are employed to get optimum parameters. The research aims to identifying the main factors that have significant effect on corrosion rate .Electro chemical corrosion Polarization study was conducted on GMAW welded 8mm thickness S355NL with welding parameters like Welding Current, Voltage ,Speed based on L9 orthogonal array in a electrolyte solution of Nacl with help of Potentiodynamic Gamry Software. Corrosion experiments conducted on Heat affected zone,Weld zone ,Base metal zone . From Corrosion experiments Icorr value be evaluated and From that Icorr value ,Corrosion rate calculated by using relation between corrosion rate and I corr . After getting Corrosion rate values it was observed that different samples had different corrosion rates . In order to find out optimum welding parameter which is having less corrosion rate GRA method was used to find optimum parameter and SEM images of high and low corrosion rate samples were studied. Finally The main objective of the project is finding optimum welding parameter which had less corrosion rate .

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144 Modeling of vendor managed inventory system Coordination of activities is a major task within the management of supply chains. When coordination fails, inventories build up and the leanness and cost efficiency of the material flow suffers. Coordination across inter organizational boundaries require collaboration, and over the years many collaboration models have been applied. VMI is a concept for inventory management aiming to improve the replenishment process (manufacturing and distribution from supplier to customer), and the main objective is to improve product availability without increasing associated inventory, distribution and production costs. The core of VMI is that the supplier has the authority and responsibility to maintain product availability for the customer. The customer places no orders and the supplier does not have to await orders to

initiate replenishment. The result of this distribution of responsibility is that one decision level in the supply chain is removed. The effect is that one source of information distortion and delays is removed and the material flow can be related to a more correct demand pattern

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145 Design and development of an intelligent maintenance planning system Effectiveness and efficiency of manufacturing depends on the manufacturing equipment. Timely detection and diagnosis of abnormal operating conditions of equipment and further correction is important for competitive manufacturing and maintenance planning is becoming more crucial. The equipment availability and optimum spare parts inventories are the result of right decision made through maintenance planning system. Limitation in large data handling and need of logical reasoning for decision making drives the use of computerized maintenance planning system. A data analytics base is generated for a real case applied to the maintenance planning process to validate the results. Maintenance strategy plays very important role in industries success. Because of automation complexity of machine increased drastically. It is not possible for human to detect cause of failure on spot and repair it as soon as possible. In such a condition Data Analytics plays very important role in predicting failure. Using this we can reduce maintenance cost and inventory. Optimum workforce can be maintained at firm. The high costs in maintaining today‘s complex and sophisticated equipment make it necessary to enhance modern maintenance management systems. Conventional condition-based maintenance (CBM) reduces the uncertainty of maintenance according to the needs indicated by the equipment condition. The intelligent predictive decision support system (IPDSS) for condition-based maintenance (CBM) supplements the conventional CBM approach by adding the capability of intelligent condition-based fault diagnosis and the power of predicting the trend of equipment deterioration. An IPDSS model, based on the recurrent neural network (RNN) approach, developed and tested and run for the critical equipment of an aeroplane. The results showed that the IPDSS model provided reliable fault diagnosis and strong predictive power for the trend of equipment deterioration. These valuable results could be used as input to an integrated maintenance management system to pre-plan and pre-schedule maintenance work, to reduce inventory costs for spare parts, to cut down unplanned forced outage and to minimise the risk of catastrophic failure.

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146 Design and development of an intelligent process planning system Traditional Process planning mainly depends on human experiences which results in low decision making efficiency, in convenient in design, un improved service levels, laziness in use of human expert time, all this involves time consuming tasks and plans generated by planners are not always consistent and there is no guarantee of efficiency in the planning of machining sequences. The initial plan may be revised several times in an attempt to achieve feasibility therefore; automatic process planning needed by modern manufacturing systems. By utilizing a computer and intelligent programming languages, human errors and working time can be reduced to be a great extent. Digital computers have used to automate some tasks of process planning. In developing a process plan, the planner can retrieve process plans for a similar part and modify them to suit the new part.

In industry, the development of intelligent process plans and to determine the standard processing times are essential functions for many organizations. These functions are time consuming and require significant skill and a great deal of experiential knowledge. To fully or partially automate these functions, it would certainly provide very tangible benefits to many organizations. So Intelligent process planning reduces the difficulties in such cases, time consumption and improve the quality of performance.

This project has focused on design and development of intelligent process planning system for turning process in CNC lathe machine. This project methodology has developed to validate the model and optimization of cutting parameters for the responses flank wears and surface roughness. This model has validated with response surface methodology (RSM) and artificial neural network (ANN). The process plan has developed with CNC program and simulated the program in WinCTS sinumerik 810 T.

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147 Multi-objective field service maintenance workforce scheduling Field services refers to all the services which are carried out either at the client site or en route it. Field services majorly involve the installations, service or repairs of systems or equipment at customer's sites. The management of field service resources is a very important task as they are responsible to enhance customer service and loyalty along with company's profitability. Field Service Management (FSM) comprises of forecasting, planning & optimization, execution, control and continuous improvement of the concerned services. In real world, resource planners are finding difficulty in allocating the right technician to the right scope due to the lack of visibility in to their availability and skills for a given period. The maintenance tasks can be broadly categorized as regular maintenance or emergency maintenance tasks. Static scheduling can take care of the regular maintenance tasks. Emergency breakdowns are dynamic in nature as the tasks have to be reassigned during maintenance. This project is a real maintenance workforce scheduling problem, this problem is formulated as a multi-objective mixed integer programming model. The aim of this project is simultaneous minimizing the workforce cost and maximizing the equipment availability. The workforce is provided by the internal and external resources using the regular time, overtime and contracting. The equipment availability is measured using the downtime due to the preventive maintenance (schedule) and failure repair (unscheduled) jobs. The priority of the imminent or potential failures can be different because of the severity effect of the failures on the system. Hence, the total weighted flow time is used as a scheduling criterion to measure the equipment availability. The proposed model is verified using a comprehensive numerical example and validated using General Algebraic Modeling System (GAMS) and the obtained results are discussed.

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148 Towards industry 4.0: maturity model and gap analysis The term industry 4.0 (I 4.0) refers to a further development stage in the organisation and management of the entire value chain process involved in manufacturing industry through the use of digital technologies to make manufacturing more agile, flexible and responsive to customers. Since Industry 4.0 transformation creates a change in a business manner and value proposition, it becomes highly important concept. Due to volatile and fast moving markets, increasing competition as well as more complex products and production, industrial companies are facing increasingly intricate challenges. So factories are rushing to become digital, connected and smart more than ever before. It is highly difficult for enterprises optimally prepare for this digital transition and overcome its challenges without having proper exposure and knowledge to compliance new Industry 4.0 business strategy. Companies that transform their businesses and operations regarding to Industry 4.0 principles face complex processes and high budgets due to dependent technologies that effect process inputs and outputs. The best way for factories to learn is by assessing organizational Maturity index and to compare with industry leaders and its competitive plant position. So, the maturity model and capability gap analysis is suitable for companies planning to transform their businesses and operations for Industry 4.0. This Project work intend to support the manufacturing industry seeking to transform their business operation to industry 4.0 by providing a framework for assessing a manufacturer's current Industry 4.0 maturity stage and identify the Gap to assist them reach a higher maturity stage in order to maximize the economic benefits of Industry 4.0. The main objective of the work is to explore existing maturity models and develop a hybrid maturity model for Industry 4.0 assessment and to find the gap between current maturity level and competitive position.

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149 Design and development of an energy efficient industrial heating system The present global scenario of energy demand emphasizes on sustainable and environmental solutions. India generates 80% of its energy through fossil fuel. The difficulties over fossil fuel dependency are source depletion, environmental problems, cost factor and economic dependency on the supply nations. The Industrial sector alone consumes 42.3% of the total energy generated in India. 25% of the total energy of industrial sector and 70% of the total energy of manufacturing sector are consumed by heating applications (process heating applications, water heating etc.). The design of an energy efficient heating system is vital for energy conservation and sustainability. The professionals and researchers explore the possibilities of energy conservation and renewable energy. The viable alternates are to be

explored, the renewable energy sources are being attempted. This work focuses to develop a framework to design & develop an energy efficient Industrial heating system. This project work is a real time problem in an automobile industry for a pre-treating process. The existing fossil fuel-based heating system was analysed and evaluated by calculating the boiler efficiency and ratio of total steam utilized to total steam generated. Two alternate heating systems were designed for the pre-treatment process of the car bodies and their respective performance indicators were computed. The performance indicators of the existing system and alternatively designed systems were compared, and the best appropriate system was selected. A framework has been developed to design and develop an energy efficient industrial heating system in a multi-dimensional aspect. This framework will be useful as a guiding tool for industries while selecting/deciding appropriate heating system for a specific application. The framework adds value to the decision-making in terms of energy efficiency and Industrial sustainability.

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150 Multi-Technician scheduling in field service Field services refer to all the services which are carried out either at the client site or en route it. Field services majorly involve the installations, service or repairs of systems or equipment at customer's sites. The management of field service resources is a very important task as they are responsible to enhance customer service and loyalty along with the company's profitability. Field Service Management (FSM) comprises of forecasting, planning & optimization, execution, control and continuous improvement of the concerned services.In the real world, resource planners are finding difficulty in allocating the right technician to the right scope due to the lack of visibility into their availability and skills for a given period. The maintenance tasks can be broadly categorized as regular maintenance or emergency maintenance tasks. Static scheduling can take care of regular maintenance tasks. Emergency breakdowns are dynamic in nature as the tasks have to be reassigned during maintenance. Due to multi-criteria involved in decision making under a dynamic and uncertain field service environment, there is a need to develop a system for resource planners to identify the right resource in short span.This project is focused on planning & optimization phase of the field services value chain. A methodology has been developed to allocate technicians in the static as well as the dynamic environment. Also, the goal of this work is to ensure that the model represents the real world situation by incorporating the different locations of the client sites and the transportation costs incurred by the technicians to travel there. The complex situation of a task requiring two or more technicians simultaneously has also been tackled in this project. Field Service Scheduling Problem (FSSP) is formulated as a Mixed Integer Non-Linear Programming (MINLP) model with constraints. This model has been validated using the General Algebraic Modeling System (GAMS) and found competent.

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151 An intelligent process planning system for micromachining Traditional Process planning mainly depends on human experiences which results in low decision making efficiency, in convenient in design, un improved service levels, laziness in use of human expert time, all this involves time consuming tasks and plans generated by planners are not always consistent and there is no guarantee of efficiency in the planning of machining sequences. The initial plan may be revised several times in an attempt to achieve feasibility therefore; automatic process planning needed by modern manufacturing systems. By utilizing a computer and intelligent programming languages, human errors and working time can be reduced to be a great extent. Digital computers have used to automate some tasks of process planning. In developing a process plan, the planner can retrieve process plans for a similar part and modify them to suit the new part. In industry, the development of intelligent process plans and to determine the standard processing times are essential functions for many organizations. These functions are time consuming and require significant skill and a great deal of experiential knowledge. To fully or partially automate these functions, it would certainly provide very tangible benefits to many organizations. So Intelligent process planning reduces the difficulties in such cases, time

consumption and improve the quality of performance. This project has focused on design and development of intelligent process planning system for turning process in CNC lathe machine. This project methodology has developed to validate the model and optimization of cutting parameters for the responses flank wears and surface roughness. This model has validated with response surface methodology (RSM) and artificial neural network (ANN). The process plan has developed with CNC program and simulated the program in WinCTS sinumerik 810 T.

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152 Analytical investigation on vendor managed inventory model VMI is a concept for inventory management aiming to improve the replenishment process (manufacturing and distribution from supplier to customer), and the main objective is to improve product availability without increasing associated inventory, distribution and production costs. The core of VMI is that the supplier has the authority and responsibility to maintain product availability for the customer. The customer places no orders and the supplier does not have to await orders to initiate replenishment. The result of this distribution of responsibility is that one decision level in the supply chain is removed. The effect is that one source of information distortion and delays is removed and the material flow can be related to a more correct demand pattern. Reduced demand information disturbances reduce demand uncertainty, and safety stock levels can be reduced. In a vendor managed inventory system, vendor or supplier is given the responsibilities of managing the customer's stock. The fundamental change is that the ordering phase of the process is saved, and the supplier is handed the authority and responsibility to take care of the entire replenishment

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153 Spare parts management using machine learning and a genetic algorithm The widespread use of location-based services has led to an increasing availability of trajectory data from urban environments. These data carry rich information that are useful for improving cities through traffic management and city planning. Yet, it also contains information about individuals which can jeopardize their privacy. In this study, we work with the New York City (NYC) taxi trips data set publicly released by the Taxi and Limousine Commission (TLC). This data set contains information about every taxi cab ride that happened in NYC. As there is an amassed evolution in the metropolitan zones, urban data are apprehended and have become certainly manageable for first-hand prospects for data – driven analysis which can be recycled for an improvement of folks who lives in urban zone. This particular project highlights, the prevailing focus on the dataset of NYC taxi trips and travel time. Traditionally the data captured from the NYC Taxi was physically analyzed by various analyst to find the superlative practice to follow and derives the output from it which would eventually aids the people who commute via taxis. during early 2000 the taxi services where exponentially developed and the data capture by NYC was in GB's, which was very difficult to analyze manually. To overcome these hitches BigData was under the limelight to analyze such a colossal dataset. There were around 180 million taxi rides in city of New York in 2014. BigData can effortlessly analyze the thousands of GB within a fractions seconds and expedite the process. This data can be analyzed for several purposes like avoiding traffics, lower rate where services are not functioning more frequency than a cab on crown location and many more. The goal of my project is to optimize travel routes for a delivery vehicle by using machine learning model predictions. This is a two-component problem: first, I train a machine learning model on the data to predict how long it will take a delivery vehicle to go from point one point to another, and I feed these predictions into a genetic algorithm which decides which is the most time efficient visit order for a given set of points.

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154 Evaluation of Augmented reality industry 4.0 attainment gap analysis The term industry 4.0 (I 4.0) refers to a further development stage in the organisation and management of the entire value chain process involved in manufacturing industry through the use of digital technologies to make manufacturing more agile, flexible and responsive to customers. In the era of Industry 4.0 Cyber-Physical Interfaces (CPI), and without any doubt Augmented Reality (AR) is one of the man-computer-machine interface with the greatest potential for

development and high impact on the efficiency of manufacturing. Together with robots, AR will configure the Smart Factory of the future as the driver of the operation and increasing its potential. Augmented Reality is an extension of Virtual Reality, where the user, the Internet of Things and the computer interact in real time by adding layers of virtual information over a live camera feed into a headset display or through any other smart device, giving the user the ability to view three-dimensional images likely the digital environment (virtual) with the physical environment (real), creating a Mixed Reality. For industrial companies the main potential challenge could be the lack of talent and skilled workers for more complex products manufacturing. While converting that challenge into opportunity, AR can help train current manual workers and turn them into a skilled workforce by integrating their manual processes into digitised processes. So factories are rushing to become digital, connected and smart more than ever before. Implementation of AR systems in factory operations is already a must for Industry 4.0 transforming organisations, in order to enhance the smartness of factories. Companies that transform their businesses and operations regarding to AR technological adoption face complex processes and high budgets due to dependent technologies. So, the capability gap analysis is suitable for companies planning to transform their businesses and operations for Industry 4.0. This thesis work supports the manufacturing industry by providing a detail gap and cause analysis on augmented reality, a smart innovation. By identifying the Gap of manufacturer's current visualising technology level, will assist them to reach a higher maturity stage in order to maximize the economic benefits of AR technology in Industry 4.0 realm. "The main objective of the work is to create complete gap analysis on capability of AR technology field of an automotive sector as a case study and to develop a Roadmap for AR development strategy".

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155 Sustainability measures for industrial heating systems The present global scenario of energy demand emphasizes on sustainable and environmental solutions. India generates 80% of its energy through fossil fuel. The difficulties over fossil fuel dependency are resource depletion, environmental problems, cost factor and economic dependency on the supply nations. The Industrial sector alone consumes 42.3% of the total energy generated in India. 25% of the total energy of industrial sector and 70% of the total energy of manufacturing sector are consumed by heating applications (process heating applications, water heating etc.). The development of an energy efficient and sustainable heating system is vital for energy conservation and sustainability. The professionals and researchers explore the possibilities of energy conservation and renewable energy. The viable alternates are to be explored, the renewable energy sources are being attempted. This work focuses to develop an energy efficient Industrial heating system and to provide sustainability solutions for industrial heating system. This project work deals with a real time problem in a heating system in an automobile industry. The washing of gear components in engine shop is catered by electric heaters. The existing electric heater system was analysed and evaluated by calculating the actual energy consumption for the process, CO2 emission by the existing heating system and cost of energy, per kW.h. To develop a sustainable solution for the existing problem, Two better sustainable heating systems were sized for the same application and their respective performance indicators were computed. The performance indicators of the existing electric heater system and alternatively sized systems were compared, and the appropriate system was selected as a sustainability measure. The sustainability measure was implemented for the case study, this implementation has yielded 50% reduction in CO2 emission and 50% reduction in energy consumption. This project will be useful as a guide for industries while selecting/deciding appropriate heating system for a specific application. The project adds value to the decision-making in terms of energy efficiency and Industrial sustainability

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156 A frame work for sustainability measure in an automobile industry The automotive industry is regarded as one of the most important and strategic industry in manufacturing sector. It is the largest manufacturing enterprise in the world and one of the most resource intensive industries of all major industrial system. However, its products and processes are a significant source of environmental impact. Thus, there is a need to evaluate sustainable manufacturing performance in this industry. Sustainable

manufacturing is currently a very important issue for governments and industries worldwide. Achieving sustainability in manufacturing activities have been recognized as a critical need due to diminishing non-renewable resources, stricter regulations related to environment and occupational safety, and increasing the consumer preference for the environmentally-friendly products. Sustainable manufacturing must respond to environmental, economical, and social challenges. In this project study of factors affecting the sustainability in automobile sector were identified and after identifying the most significant factors affecting sustainability a new framework is made which can validate a perticular automobile industry to meet sustainability requirements. The purpose of this study is to investigate the driving factors and to make a framework for sustainable manufacturing initiatives in automotive companies. Cost too high is considered to be the largest obstacle encountered in the implementation of sustainable manufacturing initiatives. This is followed by lack of understanding and knowledge andlack of top management commitment. “This thesis work supports the automobile manufacturing industries by providing a details of factors affecting sustainability and assessing automobile sector to compare their sustainable capability with the help of proposed framework.

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157 A framework for vendor managed inventory in supply chain VMI is a concept for inventory management aiming to improve the replenishment process (manufacturing and distribution from supplier to customer), and the main objective is to improve product availability without increasing associated inventory, distribution and production costs. Coordination of activities is a major task within the management of supply chains.When coordination fails, inventories build up and the leanness and cost efficiency of the material flow suffers. Coordination across inter organizational boundaries require collaboration, and over the years many collaboration models have been applied.The core of VMI is that the supplier has the authority and responsibility to maintain product availability for the customer. There is little work done to identify what is important parameters for building a VMI collaboration program, both regarding the conditions under which VMI will work and what to include in the planning process.The main purpose of this work has been to develop a framework for how to build a VMI collaboration program.The research methodology applied in this work was a combined literature review and multiple case study. Data and experience from threecases of VMI collaboration formed the fundament. This approach was selected because real life examples increases the recognition and comprehension and thereby the applicability of the results towards practitioners. Additionally, a multiple case study would embrace many parameters, some of which might not be available in single cases. These parameters would differ in relevance according to case specific circumstances and conditions

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158 A measure of readiness for industry 4.0 The term industry 4.0 (I 4.0) refers to a further development stage in the organization and management of the entire value chain process involved in manufacturing industry through the use of digital technologies to make manufacturing more agile, flexible and responsive to customers. Due to volatile and fast moving markets, competition as well as more complex products and production, industrial companies are facing increasingly intricate challenges. It is highly difficult for enterprises optimally prepare for this digital transition and overcome its challenges without having proper exposure and knowledge to compliance new Industry 4.0 business strategy. Companies that transform their businesses and operations regarding to Industry 4.0 principles face complex processes and high dependent technologies that effect process inputs and outputs. Industry 4.0 initiatives can influence whole business system via transforming the means the products are designed, produced, delivered and discarded. Industry 4.0 is relatively novel to developing nations, especially in India and needs a clear definition for proper understanding and practice in business. This work aims to recognize

key challenges to initiatives and analyze the identified key challenges to prioritize them for effective industry 4.0 concepts for sustainability in emerging economies. Industry 4.0 initiatives can help Industries to incorporate environmental protection and control initiatives as well as process safety measures in supply chains towards sustainable supply chains. However, adoption of Industry 4.0 initiatives is not so easy due to existence of many challenges Therefore, the present research identifies 15 key challenges to Industry for developing sustainability using an extensive literature review. This project work intends to support the manufacturing industry seeking to transform their business operation to industry 4.0 by prioritizing the challenges in implementation of Industry 4.0 technologies and maturity models for assessing the maturity of the Industry. The main objective of the work is to find the challenges, prioritize the main challenges from different domain and develop a Roadmap for Industrial Readiness.

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159 Performance measures to improve lean production in automotive industry The subject of performance measurement was always alongside with automobile industry, since its beginnings by Henry Ford with the first automobile assembly line for the Ford T model to the current state of the art assembly lines, improving throughout time. Nowadays, with the current automobile sector crisis, it is even more mandatory to achieve the best performance possible the lower resources. This overwhelming challenge leads to the needs of faster and more accurate ways to determine the performance in order to lead industry to right path. Performance measurement performs a major role in organizations management as the basis for decision-making and must be used for strategic planning, quality management, productivity improvement and benchmark among many other dimensions at all levels of an organization and across all sectors. Current challenge in the manufacturing engineering is based on the integration of product/process and factory concepts and the related information systems in order to synchronize product, process and factory life cycles in which tools for monitoring performance indicators are included. The following document describes the processes used by Hyundai Motor India (Bodyshop-II) to measure their performance on their Production lines, also the design and implementation of an Lean production system to improve performance.

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160 **Implementation of E-maintenance practices in automotive industry** The term E-Maintenance refers to a further development stage in the organization and management of the entire value chain process involved in manufacturing industry through the use of digital technologies to make manufacturing more agile, flexible and responsive to customers. Since E-Maintenance concept transformation creates a change in a business manner and value proposition, it becomes highly important concept. Due to volatile and fast moving markets, increasing competition as well as more complex products and production, industrial companies are facing increasingly intricate challenges. So factories are rushing to become digital, connected and smart more than ever before. It is highly difficult for enterprises optimally prepare for this digital transition and overcome its challenges without having proper exposure and knowledge to compliance new E-Maintenance business strategy. Companies that transform their businesses and operations regarding to E-Maintenance principles face complex processes and high budgets due to dependent technologies that effect process inputs and outputs. E-maintenance is an emerging concept which is commonly linked to the use of new communication and information technologies in the maintenance area. However, much work on e-maintenance gives very heterogeneous definitions by considering the main e-maintenance issues on the models or the technologies or the standards or the Web. This lack of consensus strongly harms its scientific deployment since no academic community proposes a federated framework. Thus our objective of this thesis to present an overview of the e-maintenance concept and related research activities. Nevertheless, we propose some of our own models to illustrate the work required to lead to a global e-maintenance formalization. This Project work intend to support the manufacturing industry seeking to transform their business

operation through E-Maintenance concept by providing a framework for assessing & develop &implement of new E-maintenance strategy to assist them reach a higher maturity stage in order to maximize the operational efficiency.

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161 Development of sustainability index for measuring the sustainability automotive industry Automotive companies are facing different challenges in seeking to combine the best economic performance with increased social and environmental responsibility. Thus, monitoring the level of sustainability has become a crucial part of decision support in any management system. Policy makers from industry have paid increasing attention to the implementation of sustainable development of business activities due to fierce competition in the global market and rigorous environmental standards. Indicators of sustainable development are recognized as useful tools for assessing and anticipating production performance and trends, providing early warning information and helping avoid environmental, economic and social damage, but are especially useful in supporting decision making. In this work, a sustainability index is proposed to allow individual companies and their respective supply chains to gain information on their level of economic, social and environmental sustainability. Analytic Hierarchy Process (AHP) Methodology is used to obtain the weights of the indicators and the linear aggregation method is applied to get the single index for the each indicators attributed to the sustainability pillars. The proposed index could also be used to evaluate interactions between parallel supply chains. It is also important to conduct benchmarking analysis, and analysis of supply chains belonging to the same sector or to sectors less concerned with sustainability issues. This work begins with a theoretical framework which covers the different meanings attributed to the concept of sustainability. The purpose of the this work is to review the different measurement tools for obtaining the sustainability index and thereby propose a sustainability index which would provide a company with information about their level of economic, social and environmental sustainability. This study is a contribution to the evaluation of each sustainability dimension by selection of sustainability indicators in first stage of methodology. The proposed sustainability index would represent an important contribution for supporting managers in decision-makings related to sustainability issues.

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162 Barriers in Adoption of Vendor Managed Inventory in Automobile sector : ISM Approach Vendor-managed inventory (VMI) is the latest supply chain management technology adopted by organizations to improve their business performance. . Currently most of the industries using regular inventory method, for them now is the transition phase to make a switch to Vendor Managed Inventory. This project aims to identify the potential barriers which restrict the Automobile manufacturing industries, while supplying the products from supplier (Vendor) to buyer. The barriers are identified from the literature reviews and interviews with different Technical experts from industries and academics. The study for research and design was conducted with survey of 10 outlets. This identifies the variables that are important for VMI adoption. The contextual relationship between the variables is established. This study employs an Interpretive Structural Modeling Approach (ISM) to investigate the mutual relationship between the variables. These variables are then classified into four categories, namely, autonomous, driver, dependent, and linkage, to understand their relative impact. With the help of ISM, variables those which support other variables (driving variable) and those variables which are most influenced by other variables (dependent variables) are identified by using MICMAC analysis

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163 Design of Self-assessment model to measure Industry 4.0 Readiness The term industry 4.0 (I 4.0) refers to a further development stage in the organization and management of the entire value chain process involved in manufacturing industry through

the use of digital technologies to make manufacturing more agile, flexible and responsive to customers. Due to volatile and fast moving markets, increasing competition as well as more complex products and production, industrial companies are facing increasingly intricate challenges. It is highly difficult for enterprises optimally prepare for this digital transition and overcome its challenges without having proper exposure and knowledge to compliance new Industry 4.0 business strategy. Companies that transform their businesses and operations regarding to Industry 4.0 principles face complex processes and high budgets due to dependent technologies that effect process inputs and outputs. Industry 4.0 initiatives can influence whole business system via transforming the means the products are designed, produced, delivered and discarded. Industry 4.0 is relatively novel to developing nations, especially in India and needs a clear definition for proper understanding and practice in business. This paper aims to recognize key challenges to Industry 4.0 initiatives and analyze the identified key challenges to prioritize them for effective Industry 4.0 concepts for sustainability in emerging economies. Industry 4.0 initiatives can help Industries to incorporate environmental protection and control initiatives as well as process safety measures in supply chains towards sustainable supply chains. However, adoption of Industry 4.0 initiatives is not so easy due to existence of many challenges. Therefore, the present research identifies 14 key challenges to Industry 4.0 initiatives and compare top challenges using AHP and DEMATEL. This Project work intend to support the manufacturing industry seeking to transform their business operation to industry 4.0 by prioritizing the challenges in implementation of Industry 4.0 technologies and based on the top challenges maturity models for assessing the maturity of the Industry is developed. The main objective of the work is to find the challenges, prioritize the main challenges from different domain and develop a self- assessment tool for finding maturity level of Industry.

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164 Productivity improvement through lean tools and techniques in an automotive industry Lean manufacturing is defined as a systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection. The identification and measurement of best practices, in Lean Production implementation, followed by the evaluation of its usage level, in the organizations, are the adequate way through the elimination or minimization of waste. However, the lack of a coordinated and structured roadmap, in the Lean Production implementation, may result in poor and disappointing results. In that sense, it is important to identify the steps required to assess the stages of companies toward the Lean Production system. The automotive industry under study includes assembly, testing and pre-dispatch inspection department. Kaizen improvements and 5S are the two lean tools that are taken into consideration for improvements. The data is collected for the time study and analyzed with the lean metrics. Line balancing of production line is done in order to remove the unnecessary steps and thus shorten the lead time. The lean manufacturing reduces the lead time and also increases the quality of the product. Productivity increase and cost optimization are critical tasks for automotive industry. In a competitive environment, increasing productivity without installing additional capacity enables the automotive production to avoid heavy investment and maximize their profitability. Skilled professionals who can implement productivity improvement strategies such as Lean, Six Sigma, Total Quality Management, etc. are not readily available most of the time. Thus, productivity improvement can become a costly and difficult exercise. Therefore, there is a need of a fast and cost effective solution to the problem of productivity improvement. This work offers a time saving productivity improvement and cost optimization solution for an automobile production through the implementation of lean methodology. The implementation of lean methodologies supports elimination of waste and makes available resources that were incorrectly allocated, resulting in an increment in productivity. Finally, this research aims to establish productivity improvement solution as a standard for automotive industry to achieve quick results with minimum cost incurred.

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165 **Development & implementation of intelligent e-practices & performance measures in automotive industry** In today's global competitive marketplace, there is intense pressure for manufacturing industries to continuously reduce and eliminate costly, unscheduled downtime and unexpected breakdowns. With the advent of Internet and tether-free technologies, companies necessitate dramatic changes in transforming traditional "*fail and fix* (FAF)" maintenance practices to a "*predict and prevent* (PAP)" e-maintenance methodology. E-maintenance addresses the fundamental needs of predictive intelligence tools to monitor the degradation rather than detecting the faults in a networked environment and, ultimately to optimize asset utilization in the facility Maintenance is an emerging concept which is commonly linked to the use of new communication and information technologies in the maintenance area. Intelligent maintenance systems and e-Business Predictive maintenance of plant floor assets is a critical component of the e-Manufacturing concept. Predictive maintenance systems, also referred to e-Maintenance in this document, provide manufacturing, and operating systems with near-zero downtime performance through use and integration of real-time and smart monitoring a performance assessment method. These systems can compare a product's performance through globally networked monitoring systems to shift the degradation prediction and prognostics rather than fault detection and diagnostics. . To achieve maximum performance from plant floor assets, it is possible through e-maintenance systems that can be used for monitor, analyze, compare, reconfigure, and sustain the system via a web-enabled. In addition, these intelligent decisions can be harnessed through web-enabled agents and connect them to e-business tools to achieve smart and effective service solutions. Remote and real-time assessment of machine's performance requires an integration of many different technologies including sensory devices, reasoning agents, wireless communication, virtual integration and interface platforms. This work introduces the emerging field of e-maintenance and its critical elements. Furthermore, performance measures and prediction tools are introduced for continuous assessment and prediction of a product's performance ultimately enable proactive maintenance to prevent machine from breakdowns. Recent advances on intelligent prognostic technologies and tools are discussed. Several case studies are introduced to validate these developed technologies and tools

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166 **A measure of sustainability for manufacturing process** Recently, besides recurrent financial gains, industries have been required to boost their environmental and social performance to fulfil the demands of several customers. Moreover, the need to measure the sustainability of manufacturing processes is recognized because the production and operations managers need to know how they are contributing to the triple bottom line of their respective companies. To do that, many initiatives have been developed although all of them face some limitations: (a) they are only appropriate for the company as a whole, which makes their application for a manufacturing process difficult; (b) they consider the measures for sustainability (economic, environmental and social) as separate variables with no integration among them, which could become a methodological difficulty in case indicators move in different directions. (c) they are too complicated to be used as a practical tool on the factory floor. Hence, this study proposes a framework to evaluate the sustainability level of a manufacturing process of CYLINDRICAL BODY OF OFAB 100KG BOMB USING HORIZONTAL CENTRIFUGAL CASTING, integrating the economic, environmental, and social variables into a single combined measure. Simplified these three aspects and calculate the sustainability of the casting process

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167 **Application of Data Analytics in Aerospace and Aviation Sector** With the advent of technology, it is of utmost importance to improve the technology based on past performance. It's safe to mention that analysis in aviation has been around since the time of the Wright Brothers. Now, with the emergence of aviation data analytics, analysis has stepped into an entirely new level and shows no signs of slowing down. Accordingly, with the arrival of sophisticated data analytics platforms and repair providers, aviation companies and professionals now have the power to witness a worldwide transformation of how data insights are being utilized within the industry. The aviation industries are using all the possible ways in the race and take a step ahead of the rivals. Machine Learning techniques can help aviation businesses to help them to find out the flaws in the system. So far in this project, Random Forest Classifier Machine Learning technique is used to predict flight delay and help passengers to find out flights as per their convenience before booking a ticket. Python 3 is used to develop the machine learning model.

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168 **Estimation of plastic waste using material flow analysis** Plastics have been reported as one of the major pollutants among various pollutants that are disposed of in the environment. They play a pivotal part in human life as they are cost-effective and are versatile. Plastics are known to have a mixture of many chemical components and are used for various domestic applications. Despite various useful applications, plastics take a long time to degrade. The burning of plastics releases chemicals such as phosgene and dioxides that are considered a hazard to the ecosystem. The toxic debris that is released from the plastics enters the food chain and water bodies in the form of microplastics. Inadequate waste management practices have led to significant plastic pollution of water bodies. In this work, an MFA diagram is drawn to visualize the plastic flow in different phases while going through different processes and the plastic waste entering the environment is calculated. Using the diagram the projection for plastic waste entering the environment in 2020 is also seen.

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169 **Selection of criteria for sustainability in industrial system** Our vision is a future industrial system that delivers high value to its growing base of customers around the globe, while using, at most, a quarter of the current resources. This sustainable industrial system would be very different to today's global industry–less homogenous with different business models and different relationships, creating different products and services – requiring new strategies, frameworks, and tools. This paper is intended to assist continuous measurement and improvement of their "triple bottom line," i.e., the economic, environmental, and societal performance of their products, facilities, and enterprise. As the real-world problems are so tangled, so the task of decision making associated with them is equally complex. Therefore, some efficient techniques are required which limelight the best solution. For the choice of the optimal selection with respect to the given criteria, this paper has summarized three major and useful techniques of Multiple Criteria Decision Making (MCDM), namely, WSM (Weighted Sum Method), WPM (Weighted product model), AHP (Analytic Hierarchy Process) and TOPSIS (Technique for Ordered Preference by Similarity to Ideal Solution). The paper highlights the basic steps involved in each of the techniques for choosing the most suitable alternative from among the varied options under consideration. providing recommendations for educators, researchers, industrialists, and policy makers. An increasing number of organizations now publish sustainability rankings to evaluate the environmental, social, and economic sustainability of companies. While the purpose of many sustainability rankings varies and may range from informing the public to informing investment decisions, many rankings also aim to improve the sustainability of companies. it was challenging to identify the causes or impacts of a single ranking using externally available information. Rankings that are well-recognized tend to have a greater impact on companies than those that are newer, focus on a specific topic, or are in only one region. Rankings can generally impact companies by sparking discussion among employees, encouraging companies to evaluate their strategy to communicate sustainability, and providing a platform for sustainability professionals to communicate the company's successes. [GO TO LIST]

170 **Company Bankruptcy Prediction using Machine Learning Techniques** With the advent of technology, it is of utmost importance to improve the technology based on past performance. Bankruptcy Prediction has been studies over many years with the help of traditional statistical models and machine learning techniques. Data analysis has stepped into an entirely new level and shows no signs of slowing down. Accordingly, with the arrival of sophisticated data analytics platforms, investors and corporate banks now have the power to witness a worldwide transformation of how data insights are being utilized within the company. Machine Learning techniques can help businesses to help them to find out the flaws in the system and give early warning to the businesses. So far in this project, K Nearest Neighbour and Random Forest Classifier Machine Learning technique is used for bankruptcy prediction. Python 3 is used to develop the machine learning models. [GO TO LIST]

171 **Crop Price Prediction Using Time Series Models** The fluctuations in prices of agricultural commodities have an adverse effect on the GDP of a country. The farmers are emotionally and financially affected as their years of hard work go in vain. Analytics in the agriculture market is expected to grow because of the application of modern technology, rising population and, improved productivity. Understanding the price fluctuations can provide an insight for the government and organizations in taking necessary decisions for managing risk. The government can provide loans and insurance at reduced interest rates. The farmers can also take timely actions in improving the production of the crop. The competition among the business organizations- from the input suppliers to retailers in the supply chain is ever increasing, and analytics has provided a means for the competitors in getting ahead. In the present work, data regarding the daily prices of tomato in the Binny mills(F&V) market, Bangalore is collected from 1april,2020 to 31march,2021. The SARIMA, PROPHET and a combination model are fit into the data and their accuracies are evaluated using the MAPE and RMSE performance metrics. The proposed combination model is observed to be predicting the prices with MAPE and RMSE as 22.233 and 343.277 respectively. the Hence the combination model is observed to be the best fit. [GO TO LIST]

172. **Sustainability Measures In Industrial Manufacturing Processes** Due to the rapid depletion of natural resources and undesired environmental changes in a global scale, it is necessary to conserve the natural resources and protect the environment also we need to develop process which is economically and socially sustainable. Industries which uses heating system for automotive industries must have the necessarily consider criteria like Economic factors like (cost of energy), environmental factors (carbon foot print) Social (serviceability and maintenance) There are number of variables which we need to integrate. Since the selection of the best heating method involves complex decision variables, it is considered to be a multiple criterion decision-making (MCDM) problem. This article develops an evaluation model based on the technique for order performance by similarity to ideal solution (TOPSIS) to enable the industry practitioners to perform performance evaluation in a fuzzy environment. The purpose of the study is to determine the best method for heating system in automotive industries among the various heating system processes. By observing the results, it is identified that solar thermal is found to be the best heating process using the integrated approach.
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173. **Design And Development Of Prediction Model For Spark Plasma Sintering Using Multiple Regression Analysis And Artificial Neural Network** Metal matrix composites based on Aluminium are developed for light-based applications, particularly in the aerospace and automobile sectors. Optimization of process parameters is usually undertaken to achieve more efficient and cost-effective process conditions. This work

deals with the design and development of predictive model for spark plasma sintering process parameters which include sintering temperature, pressure, dwell time and heating rate for the development of Al-CNTs-Nb nanocomposite. Taguchi's Design of Experiment (DOE), Multiple Regression Analysis, and Artificial neural network used here, and an empirical model has been developed by considering variance analysis (ANOVA), to establish relationships among the control factor and response variables.
A Feed-forward back-propagation neural network (FF-BPNN) is used to determine the qualitative characteristics of the process, and the accuracy of the BPNN system is attributed with mathematical models based on Taguchi's method (DOE). The ANN model predicted surface hardness values are near the experimental findings, results indicate overall higher accuracy in the ANN method than Taguchi's model. The normal residual plot for the individual regression models is validated and models are found to be fit.

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174. **Design and Development of Prediction Model for Laser Assisted Additive Manufacturing Using Multiple Regression Analysis And Artificial Neural** Laser-based additive manufacturing is a promising technique to manufacture complex parts. Laser additive manufacturing (LAM) processes are classified based on material feeding as a powder bed fusion (PBF) and direct energy deposition (DED). In PBF, the 3D part is developed layer-by-layer by scanning powder bed using laser beam Selective laser melting (SLM) by SLM solutions, selective laser sintering (SLS) and direct metal laser sintering (DMLS) by EOS are variants of PBF. The laser power range on 100-1000 W is being used depending upon the manufacturer's preference. There is a need to develop generalized models which can dynamically predict a wide variety of process parameters to assist the intelligent manufacturing system. The intelligent tools such as Neural network, fuzzy logic and evolutionary algorithms are being attempted in the decision-making process to increase flexibility, accuracy, and productivity In this study, a prediction model is developed for obtaining the optimal process parameters, including height, hatch spacing and hardness top of product, in the LAM process of the IN718 alloy. For this purpose, artificial neural network (ANN) modeling with various algorithms is employed to estimate the process outputs, namely, sample height and surface hardness. The modeling results fit perfectly with the experimental output, and this consequently proves the benefit of ANN modeling for predicting the optimal process parameters. Sample height and surface hardness were measured. Regression analysis is done to develop the best fitness function for the given data using Minitab 19 software. Feed forward back propagation neural network models were developed and used for predicting the parameters using MATLAB software.

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175. Sustainability Measures in Additively Manufactured Products

Additive manufacturing processes, such as Laser Additive Manufacturing (LAM), has become increasingly established in metal-processing industry offering versatile possibilities for producing individualized components or lightweight structures. LAM machines offer ecological and economical potentials due to comparatively low power and material demand. In general, Additive Manufacturing (AM), has been considered an alternative to the traditional manufacturing techniques, such as Subtractive Machining (SM), because allows the creation of new, light and complex products with an innovative design and manufacturing. Sustainability assessment is essential to identify and select the best technology among the alternative candidates. Sustainability of LAM needs to be evaluated for finding an optimal compromise between technical development and sustainability performance. The Life Cycle Assessment (LCA) methodology is applied to investigate the sustainability of Laser Engineered Net Shaping (LENS) by comparing that of the Computer Numerical Control (CNC) machining. The aim of thisresearch isto analyze and comparethe environmental impact between additive and subtractive

manufacturing. In particular, CNC (SM) and LENS (AM) technologies have been chosen. A common spur gear has been defined as a case study. Therefore, the analysis allows to define the ecological characteristics of a new production technology compared to a gold standard such as CNC machining. Hence, the advantages and disadvantages of the reviewed additivetechnology are exposed. The ReCiPe midpoint results, shows advantages in term of environmental impact for the LENS manufacturing process,in particular for the damage to resource indicator.

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176 Fabrication Of AA7075 Matrix Surface Composites By Friction Stir Processing And Prediction Of Parameters Via Artificial Neural Networks Friction stir processing is an avant-garde technique of producing new surface composite or changing the different properties of a material through intense, solid-state localized material plastic deformation. Optimization of process parameters is usually undertaken to achieve more efficient and cost-effective process conditions. The present work is carried out for the parametric effects like tool rotation speed, traverse speed, and reinforcement type in friction stir processing of AA7075 on the mechanical properties. Taguchi's Design of Experiment (DOE), Multiple Regression Analysis, and Artificial neural network (ANN) is used here, and an empirical model has been developed by considering variance analysis (ANOVA), to establish relationships among the control factor and response variables. A Feed-forward back-propagation neural network (FF-BPNN) is used to determine the qualitative characteristics of the process, and the accuracy of the Back-propagation neural network (BPNN) system is attributed to mathematical models based on Taguchi's Design of Experiment (DOE). The ANN model predicted ultimate tensile strength values are near the experimental findings, results indicate overall higher accuracy in the ANN method than Taguchi's model. The normal residual plot for the individual regression models is validated and models are found to be fit.

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177 Design and Stress Analysis Of An Aircraft Components Bracket An aircraft is a complex structure, but a very efficient manmade flying machine. Aircraft are generally built-up from the basic components of wings, fuselage, tail units and control surfaces. The load-bearing members of these main sections, those subjected to major forces, are called the airframe. Normally the aircraft will have wing-fuselage attachments at more than one location.. For the continued airworthiness of an aircraft during its entire economic service life, fatigue and damage tolerance design, analysis, testing, and service experience correlation play a pivotal role. Brackets are connector type elements widely used as structural supports to carry hydraulic and electrical lines used in engines, wings, and landing gear links. Failure of brackets may lead to the catastrophic failure of the whole structure. Finite element analysis studies and experimental data help the designer to safeguard the structure from catastrophic failure. In this study, design, and stress analysis of Hold Open Rod (HOR) bracket is performed. The Application of is that a Hold open rod bracket is attached to the hold open rod and it holds the Fan Cowl in open condition. Also, to Perform Trade study to choose the material based on its strength/weight ratio. Perform FE Modelling, Bracket strength analysis, Lug and Pin analysis. Initially a CAD model of bracket is developed using CATIA V5 software by taking appropriate dimensions. Further for pre-processing and post-processing CAD model was imported to hypermesh optistruct 2019. Linear static analysis has been performed on the bracket using hypermesh 2019 engineering tool software for getting contour plot of stress and displacement of bracket. Airframe stress analysis and sizing by Michael Niu textbook is used to derive the dimensions of holes and fasteners for bracket plate. Metallic Materials Properties Development and Standardization (MMPDS) book is used for material selection. Tetramesh has been selected to mesh the 3D CAD model of bracket. Optistruct solver is used to analysis in hypermesh. The results generated form analysis is verified

using hand calculation by using Michael Niu book.Three materials have been selected namely steel, aluminum alloy and titanium alloy and compared for analysis for same dimensions of bracket.

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178 Evaluation of sustainability measures in manufacturing industry The manufacturing industry is one of the most important and strategic industries. Products and processes in manufacturing are significant sources of environmental impact. Nowadays increased concern towards environmental aspects, Government laws and regulations made it necessary to evaluate sustainable manufacturing performance. Sustainable manufacturing is currently a very important issue for governments and industries worldwide. Achieving sustainability in manufacturing industries has been recognized as a critical need due to diminishing non-renewable resources and strict regulations related to the environment. Sustainability is important for industries due to competitive advantage and enhanced company image and reputation. Sustainability assessment tools are the most commonly applied methodologies for measuring sustainability performance. The tools are also divided by their spatial focus and the level of nature–society system integration. In this project Triple Bottom Line (TBL) concept is used. The TBL is an accounting framework that incorporates three dimensions of performance: social, environmental, and financial. This differs from traditional reporting frameworks as it includes ecological (or environmental) and social measures that can be difficult to assign appropriate means of measurement.
The purpose of this study is to find out sustainability indicators and their importance level. Sustainability factors and their subfactors are identified using online surveys and Corporate Social Responsibility (CSR) reports published by leading manufacturing industries in India. Ranking of this factor is done with the help of Multi-Criteria Decision Making techniques (MCDM) which are Analytic Hierarchy Process (AHP) technique and Technique for Order Performance by Similarity to Ideal Solution (TOPSIS). This sustainability indicator framework will guide industries to improve sustainability performance and contribute to achieving sustainable development goals.

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179 Investigations on Corrosion Resistance of Nickel based Super Alloy fabricated using Wire and Arc Additive Manufacturing Process Additive manufacturing ensures the global adoptionof zero-to-minimal waste and lean manufacturing systems. This is crucial for repairing, replacing, rebuilding, and rapidly producing components. The current study employs wire arc additive manufacturing (WAAM) with metal inert gas welding, which is affordable an versatile. The filler material used is Alloy 625, a highly corrosion- resistance alloy used extensively in the marine and chemical sectors.
In this project work, Inconel 625 wall was fabricated with interpass layer temperature of 200°C and 300°C and corrosion study was done. The microstructural and macrostructural evolution was also studied by optical and electron microscopy techniques. A significant improvement in the mechanical strength of the WAAM part was observed, which was attributed to the refined grain structure and fine dispertion of alloyed particles to the parent metal. Wire arc additively manufactured alloy 625 with interpass layer temperature of 200°C has a corrosion rate of 0.01315 mmpy, while the interpass layer temperature 300°C has a corrosion rate of 0.007255 mmpy. Tafel's extrapolation method computed corrosion current density and corrosion potential. The WAAM component was found to exhibit good corrosion behavior from the corrosion testing and lastly it was concluded thtat Inconel 625 with interpass layer temperature 300°C shows less corrosion rate and hence it has good corrosion resistance.

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180 Framework for Auditing sustainability in Manufacturing Industries: Sustainable manufacturing has emerged as a crucial issue for governments and industries worldwide. The urgent need to address sustainability in manufacturing arises from the depletion of non-renewable resources and the increasingly stringent environmental regulations imposed on businesses. Achieving sustainability in manufacturing is not only a moral obligation but also a means to secure long-term viability. The purpose of this research is to design sustainability auditing framework for manufacturing practices across industrial sectors and to identify the critical factors for its success implementation. Sustainable manufacturing practices enable the manufacturing organizations to survive in competitive environment. For this purpose empirical data are collected to measure sustainable manufacturing practices from industry experts. Structural Equation Modelling (SEM) technique is used to build structural models. A structural model consisting of 4 constructs and 26 indicators has been created. Four constructs selected for this research include social, economical, technical and environmental factors. After that statistical estimates are used to validate the built model. The data analysis enables the acceptance or rejection of hypothesis that has been stated on the basis of structural model. The result shows the correlation between sustainable manufacturing practices and organizational performance among industries being surveyed. Importance Performance Map Analysis (IPMA) technique gives relative importance and performance of constructs. The current study will help managers of manufacturing businesses make effective decisions about auditing sustainability in industry and improve sustainability performance.

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181 Estimation of Load Increase Factor for Missing Fasteners using Finite Element Parametric Analysis

Fasteners plays a critical role in the construction and maintenance of aircraft. They are used to join various components together, ensuring structural integrity and safety. In aircraft skin panel, frame and bulkhead joints, fuselage and wing components has so many fasteners and if any of the fasteners are missing from these components then the load carried by the surrounding fasteners will be increased by some factor. In this project work modelling of 24*6 inches plate is done which carries 29 fasteners and which is made of Aluminum7075, and fasteners are made of Aluminum2219. Fixing one end of the plate and applying load on another end we calculated load carried by each fastener and if any one fastener is missing then we determine the load increase factor (LIF) on the surrounding fasteners due to missing fasteners (number1, 2, and 3), the study also evaluates the impact of missing fastener and pitch distance. The results are plotted to find out the correlation of parameters over the LIF formula, LIF is found based on the results using parameters like no. of missing fasteners, and pitch distance of the fasteners. Load increase factor formula for Aluminum7075 plate with running missing fasteners is Y= 33.647*X0.8226% where ‘Y’ is the load increase in percentage and ‘X’ is the continuous number of missing fasteners. In this project some iterations are performed for staggered connections also if there are 1,2,3 and 4 number of fasteners between two missing fasteners then the load increase factor formula comes as Y= 69.732*X-0.617% where ‘Y’ is load increase in percentage and ‘X’ is number of fasteners in between two missing fasteners. Similarly, it was evaluated when the fasteners are missing from the edge of the plate. Also, it was concluded that in staggered connections only two fasteners surrounding to missing fasteners will carry the most amount of load and if more than 4 fasteners are between two missing fasteners then one missing fastener will not have impact on another fastener

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182 Advancing Sustainability in Manufacturing:An Experimental Investigation into Micro Drilling of Magnesium Alloy Using TiAlN-Coated HSS Tools

This experimental study delves into the realm of sustainable micro drilling, focusing on magnesium (Mg) alloy machining, a critical area in manufacturing lightweight components for various industries. The research centers around the application of a Titanium Aluminum Nitride (TiAlN) coated High-Speed Steel (HSS) tool, aiming to enhance the drilling process's sustainability by optimizing tool performance.Magnesium

alloys are prized for their lightweight properties, making them vital in aerospace, automotive, and electronic applications. However, their challenging machinability poses hurdles in conventional drilling processes. This study seeks to address these challenges through the utilization of TiAlN-coated HSS tools, renowned for their wear resistance and durability. The coating's composition is expected to mitigate tool wear and enhance overall tool life, contributing to sustainability by reducing tool replacements and waste generation. The experimental design involves a systematic investigation of key parameters such as cutting speed, feed rate, and tool geometry. Through rigorous testing, the study aims to establish the optimal conditions for sustainable micro-drilling of Mg alloy. The research will assess various performance metrics, including tool wear, surface finish, and dimensional accuracy, to comprehensively evaluate the effectiveness of the TiAlN-coated HSS tool. In addition to technological advancements, the study integrates sustainability considerations by assessing the environmental impact of the machining process. This involves analyzing energy consumption, waste generation, and resource utilization, aligning with the growing emphasis on eco-friendly manufacturing practices. In conclusion, this experimental study explores the sustainable micro-drilling of magnesium alloy using a TiAlN-coated HSS tool, aiming to optimize machining parameters, enhance tool performance, and minimize environmental impact. The findings hold the potential to revolutionize micro-drilling practices in magnesium alloy applications, fostering advancements in both technological and sustainable dimensions of manufacturing.

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183 Sustainable Measures for Micro Turning

The thesis investigates the critical realm of sustainability in micro turning, a precision machining process essential to the manufacturing industry. Focused on environmentally conscious practices, the research systematically identifies, analyses, and optimizes sustainable parameters within micro turning operations. Addressing a contemporary challenge in the manufacturing sector, the study explores the implementation of online predictive strategies on the shop floor to detect tool breakage precisely while enhancing the quality of produced components. Micro-turning processes using AISI 304 stainless steel wire are scrutinized, with key parameters such as feed rate, depth of cut, cooling system, and tool type influencing critical responses like surface roughness, passive force, feed rate force, cutting force, and microhardness. Experimental tests reveal that the carbide tool with code TPMT, coupled with lower input parameters, achieves superior surface roughness. The study underscores the significance of feed rate as the most influential parameter on surface quality, while cutting efforts are impacted by both feed rate and depth of cut. Notably, the cooling system exhibits limited efficiency in reducing cutting efforts, with tool geometry and the Minimum Quantity Lubrication (MQL) system proving more effective in inducing micro-scale material hardening. This sustainability-oriented exploration aligns with the overarching goal of advancing micro turning practices for stainless steel wire, contributing valuable insights into optimizing processes while showcasing the potential for intricate component manufacturing with minimal environmental impact. Keywords: sustainability, micro turning, stainless steel, AISI 304, machinability, cutting parameters, minimum quantity lubrication (MQL).

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184 A framework for sustainable manufacturing of nano composites

The study focuses on the sustainability measures in Friction Stir Processing (FSP) of AA 7075-T6 with Graphene Oxide (GO) and Graphene Nano Platelets (GNPs) surface nano composites. Taguchi Grey Relational Analysis (GRA) is employed to optimize the mechanical properties, energy consumption and carbon dioxide emissions. The considered variables utilized are welding speed, welding transverse speed, and nano-particles. The study uses Taguchi L9 orthogonal array methodology with three variable levels, and the results are analyzed using GRA. The findings reveal that a minimum energy consumption of 0.81 kWh and carbon dioxide emission of 0.660 kg CO2/kWh are obtained for

rotational speed of 900 rpm, welding speed of 50 mm/min, and graphene oxide powder combination. The study demonstrates the feasibility of using Taguchi and GRA for optimizing sustainable process variables in friction stir processing of aluminum-based metal matrix composites.

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185 Assessing optimum micro-drilling parameters and environmental impacts in micro-drilling operation of mg alloy using hss tool

This experimental study delves into the realm of sustainable micro drilling, focusing on magnesium (Mg) alloy machining, a critical area in manufacturing lightweight components for various industries. The research centers around the application of a Titanium Aluminum Nitride (TiAlN) coated High-Speed Steel (HSS) tool, aiming to enhance the drilling process's sustainability by optimizing tool performance. Magnesium alloys are prized for their lightweight properties, making them vital in aerospace, automotive, and electronic applications. However, their challenging machinability poses hurdles in conventional drilling processes. This study seeks to address these challenges through the utilization of TiAlN-coated HSS tools, renowned for their wear resistance and durability. The coating's composition is expected to mitigate tool wear and enhance overall tool life, contributing to sustainability by reducing tool replacements and waste generation. The optimized drilling parameters are derived by the implementation of Whale Optimization algorithm. This method is based on the hunting behavior of humpback Whale which is known as the bubble net feeding method. This experimental study explores the sustainable micro-drilling of magnesium alloy using a TiAlN-coated HSS tool, aiming to optimize machining parameters, enhance tool performance, and minimize environmental impact. The findings hold the potential to revolutionize micro-drilling practices in magnesium alloy applications, fostering advancements in both technological and sustainable dimensions of manufacturing.

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186 A comprehensive lca of micro turning using sima pro software to establish sustainability

The imperative for sustainable development has never been more critical, necessitating robust methods to assess and mitigate environmental impacts across various sectors. Life Cycle Assessment (LCA) stands out as a pivotal methodology for evaluating the environmental performance of products, processes, or services throughout their life cycles from raw material extraction through production, use, and disposal. This project focuses on performing a comprehensive LCA using the Sima Pro software to establish sustainability metrics for a selected case study.

The objective of this study is to leverage SimaPro's advanced capabilities to conduct a detailed environmental impact analysis. Sima Pro is renowned for its extensive database, flexibility, and precision in modelling complex life cycle processes. By systematically evaluating the inputs and outputs at each stage of the product's life cycle, this project aims to identify hotspots of environmental impact and propose strategies for improvement.

This study not only underscores the utility of Sima Pro in conducting detailed LCAs but also contributes valuable insights into the sustainability challenges and opportunities within the consumer electronics industry. By providing a comprehensive analysis, this project aims to inform stakeholders and guide strategic decision-making towards more sustainable practices. Ultimately, the research aspires to contribute to the broader goal of achieving sustainability in industrial processes and product lifecycles, aligning with global environmental objectives.

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187 A study on wear and corrosion resistance in AA7075 T6 aluminium alloy using nano-particle reinforcements and friction stir processing: a machine learning approach

This study investigates the synergistic effects of incorporating Graphene Oxide (GO), Graphene (Gr), and Silicon Carbide (SiC) nano powders into aluminum alloys during Friction Stir Processing (FSP), followed by comprehensive wear and corrosion analysis. FSP is a solid-state joining technique renowned for its ability to refine grain structure and improve mechanical properties. However, the addition of nano powders presents a novel approach to further enhance these properties. The experimental investigation comprises FSP of aluminum alloys reinforced with GO, Gr, and SiC nano powders, with input factors such as varying tool rotational speed and traverse speed to explore their influence on microstructure and mechanical properties. Wear and corrosion tests are conducted to evaluate the tribological and corrosive behavior of the processed materials. Furthermore, this research employs machine learning techniques, including Linear Regression and Support Vector Regression (SVR), to predict the wear and corrosion resistance of the processed materials. Leveraging the datasets generated from experimental tests, these models are trained to provide insights into the relationship between processing parameters, nano powder concentrations, and material properties. Additionally, Grey Relational Analysis (GRA) multi-optimization methodology is employed to identify the optimal combination of process parameters and nano powder concentrations for maximizing wear and corrosion resistance simultaneously. GRA facilitates the exploration of the complex interdependencies among multiple input parameters and their effects on the desired output properties.

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188 EFFECT OF FRICTION STIR PROCESSING PARAMETERS ON SURFACE ROUGHNESS AND TEMPERATURE IN NANO-COMPOSITES

This work investigates the influence of input parameters on temperature and surface characteristics of AA7075-T6 surface nanocomposites fabricated through Friction Stir Processing (FSP). The experiments were conducted based on Taguchi L9 orthogonal array with four factors and three levels. The factors were chosen as tool traverse speed (TTS), tool rotational speed (TRS), Tool profile (TP) and reinforcement type (RT). For each factor, the response of temperature and surface characteristics were measured. TTS and TRS were chosen based on low, medium and high criteria. For TP. plain, threaded and gear tooth profile were designed. Carbonaceous and ceramic particles were chosen as reinforcement types. The results highlighted significant variations in surface roughness and microstructural properties across different combinations of TPs, RT, TTS and TRS. AA7075-T6+GO surface nanocomposite showed best in terms of temperature and surface characteristics, while AA7075-T6+GO surface nanocomposite showed least. The surface characteristics and temperature of AA7075-T6+SiC surface nanocomposite lies between other surface nanocomposites.

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189 RESIDUAL STRESS ANALYSIS OF LASER SHOCK PEENED ADDITIVELY MANUFACTURED SS316L

This study investigates the impact of laser shock perning (LSP) and heat treatment on additively manufactured stainless steel SS3161. components produced via laser powder bed fusion (LPBF). The research explores how LSP enhances mechanical characteristics and operational lifespan by significantly reducing residual stress and increasing roughness parameters. The primary objective is to analyze the effects of consecutive LSP applications, without ablative coating and using low pulse energy, on surface properties, residual stress distribution, and microhardness of LPBF-fabricated SS316L samples. Results indicate that surface quality experiences slight deterioration due to the combined impact of ablative surface and surface damage from high-energy plasma production. Despite this, successive LSP applications lead to a notable enhancement of compressive residual stresses (CRS) distributed evenly along the central axis and sharp edges, as opposed to the non-uniform

stress magnitudes observed in the as-built condition. Each iteration of LSP results in an increased CRS. This improvement is attributed to repetitive shock wave impacts, inducing plastic deformation and surface grain refinement, as confirmed by x-ray diffraction (XRD) studies and Cosa plots.Five unique point are chosen and residual stress result is analyzed for those points and results are verified with the simulations too using finite element analysis.
These findings contribute to the optimization of post-processing techniques for additively manufactured components, potentially expanding their application in critical industries specially targeting its application for biomedical implants.

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190 AN EVALUATION MODEL FOR ESTABLISHING SUSTAINABILITY

Sustainability in manufacturing industries necessitates a comprehensive evaluation of factors impacting environmental, social, and economic dimensions. This study focuses exclusively on manufacturing plant operations, systematically analysing sustainability indicators derived from Corporate Social Responsibility (CSR) reports of major organizations over several financial years. Key areas of assessment include environmental metrics such as renewable energy use and waste management, social initiatives like gender equality and disaster awareness, and economic factors including cost-effective energy measures and disaster funding. A multi-method approach employing Multi-Criteria Decision-Making (MCDM) techniques, including the Analytic Hierarchy Process (AHP) and Fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL), ensures rigorous evaluation. AHP facilitates prioritization of subfactors through hierarchical decomposition and pairwise comparisons, while Fuzzy DEMATEL uncovers causal relationships, visualized through a cause-effect diagram. The research delivers actionable insights, providing a ranked list of sustainability measures and highlighting critical interdependencies among factors. These findings offer strategic guidance for industries to optimize sustainability efforts, resource allocation, and operational efficiency. By leveraging robust frameworks like the Triple Bottom Line (TBL), the study bridges theoretical principles with practical applications, advancing sustainability assessment methodologies. This work supports the development of balanced strategies that align environmental stewardship, social responsibility, and economic growth. It serves as a valuable resource for stakeholders seeking to enhance corporate sustainability practices and achieve long-term industrial resilience.

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191 Study on investigation of metallurgical and corrosion behaviour of surface nano-composites fabricated by friction stir processing
This work investigates the influence of input parameters on temperature and surface characteristics of AA7075-T6 surface nanocomposites fabricated through Friction Stir Processing (FSP). The experiments were conducted based on Taguchi L9 orthogonal array with four factors and three levels. The factors were chosen as tool traverse speed (TTS), tool rotational speed (TRS), Tool profile (TP) and reinforcement type (RT). For each factor, the response of temperature and surface characteristics were measured. TTS and TRS were chosen based on low, medium and high criteria. For TP, plain, threaded and gear tooth profile were designed. Carbonaceous and ceramic particles were chosen as reinforcement types. The results highlighted significant variations in surface roughness and microstructural properties across different combinations of TPs, RT, TTS and TRS. AA7075-T6+GO surface nanocomposite showed best in terms of temperature and surface characteristics, while AA7075-T6+GO surface nanocomposite showed least. The surface characteristics and temperature of AA7075-T6+SiC surface nanocomposite lies between other surface nanocomposites.

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192 EBSD analysis of laser shock peened additively manufactured SS316L
This study explores the synergistic effects of heat treatment and Laser Shock Peening (LSP) on the microstructural and mechanical performance of stainless steel 316L

(SS316L). Heat treatment was employed to relieve residual stress and promote phase stability, while LSP was applied as a surface modification technique to enhance mechanical integrity. The present study uses electron backscatter diffraction (EBSD) analysis to examine the microstructural evolution of stainless steel SS316L components that are additively manufactured. The components, which are produced using Selective Laser Melting (SLM), are subjected to a thorough post-processing processes in order to investigate how heat treatment and laser shock peening (LSP) affect phase distribution, crystallographic orientation, and grain shape. This study evaluates the generated plastic deformation and its effect on grain refinement and texture evolution using successive LSP applications—without ablative coating and using low pulse energy. Grain boundary density has significantly increased, according to EBSD research, which improves mechanical qualities like hardness and fatigue resistance. The growth of finer microstructures is further demonstrated by variations in inverted pole figures (IPF), kernel average misorientation (KAM), and misorientation angles, especially along high strain zones.

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193 Measure of sustainability in an industry

Sustainability evaluation in the manufacturing sector has become an increasingly significant concern due to environmental degradation, resource scarcity, and heightened social awareness. In the pump industry, which is both energy-intensive and resource-dependent, assessing sustainability through a structured framework is critical for ensuring long-term operational viability and environmental stewardship. This study develops and implements a comprehensive model to evaluate sustainability performance using the Triple Bottom Line (TBL) framework, which encompasses economic, environmental, and social dimensions. By integrating the Fuzzy DEMATEL (Decision-Making Trial and Evaluation Laboratory) and AHP method, this research identifies and categorizes key sustainability indicators into cause and effect factors, highlighting their interrelationships and influences. The methodology provides a systematic approach for understanding the dynamics of sustainability criteria and supports strategic decision-making. Results indicate that energy consumption, renewable energy use, R&D investment, and employee training are significant drivers of sustainability outcomes such as reduced emissions, improved safety, and enhanced green revenue. The proposed framework not only bridges the gap between theoretical models and practical implementation but also offers actionable insights for industrial managers seeking to align operations with sustainability goals. The research delivers actionable insights, providing a ranked list of sustainability measures and highlighting critical interdependencies among factors. These findings offer strategic guidance for industries to optimize sustainability efforts, resource allocation, and operational efficiency. By leveraging robust frameworks like the Triple Bottom Line (TBL), the study bridges theoretical principles with practical applications, advancing sustainability assessment methodologies. It serves as a valuable resource for stakeholders seeking to enhance corporate sustainability practices and achieve long term industrial resilience.

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194 Effect of mechanical behavior of additively manufactured AISI 316L ss material

This study explores the synergistic effects of heat treatment and Laser Shock Peening (LSP) on the mechanical performance of stainless steel 316L (AISI SS 316L). Heat treatment was employed to relieve residual stress and promote phase stability, while LSP was applied as a surface modification technique to enhance mechanical integrity. The present study uses Tensile strength, Vicker's Hardness and Fractography analysis to examine the mechanical properties of stainless steel AISI SS316L components that are additively manufactured. The components, which are produced using Laser powder bed fusion (LPBF), are subjected to a

thorough post-processing processes in order to investigate how heat treatment and laser shock peening (LSP) affect the strength, hardness and failure.

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195 Effect of Heat Treatment and Laser Shock Peening on the Metallurgical Behaviour of Additively Manufactured AlSi10Mg Alloy

This study explores the synergistic effects of heat treatment and Laser Shock Peening (LSP) on the microstructural and mechanical performance of aluminium alloy AlSi10Mg. Heat treatment was employed to relieve residual stress and promote phase stability, while LSP was applied as a surface modification technique to enhance mechanical integrity. The present study uses electron backscatter diffraction (EBSD) analysis to examine the microstructural evolution of aluminium alloy AlSi10Mg components that are additively manufactured. The components, produced using Selective Laser Melting (SLM), undergo thorough post-processing to investigate the effects of heat treatment and laser shock peening (LSP) on phase distribution, crystallographic orientation, and grain shape. This study evaluates the generated plastic deformation and its effect on grain refinement and texture evolution using successive LSP applications—without ablative coating and using low pulse energy. Grain boundary density has significantly increased, according to EBSD research, which improves mechanical qualities like hardness and fatigue resistance. The growth of finer microstructures is further demonstrated by variations in inverted pole figures (IPF), kernel average misorientation (KAM), and misorientation angles, especially along high-strain zones.

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196 E-MAINTENANCE USING ARTIFICIAL NEURAL NETWORKS

E-maintenance represents a modern maintenance philosophy that integrates digital technologies, data analytics, and intelligent decision-making tools to enhance the reliability and availability of industrial equipment. With increasing automation and machine complexity, maintenance practices have evolved from reactive approaches toward predictive and condition-based strategies. Among the various E-maintenance modules, effective spare-parts management plays a critical role, as timely availability of critical spares directly affects machine uptime, maintenance readiness, and production continuity. Inaccurate spare-parts forecasting often leads to unplanned downtime, excess inventory costs, or delayed maintenance actions. In this context, the present work focuses on developing an AI-based E-maintenance framework for predicting the demand of critical spare parts in an Orbital TIG welding machine. Due to the limited availability of real industrial failure data, realistic datasets were generated by simulating spare consumption patterns using historical trends and key operational parameters such as weld cycles, arc-on hours, and non-arc-on hours. Separate Back Propagation Neural Network (BPNN) models were developed and trained in MATLAB for three critical components: Weld Head, Torch Cooling Line, and Weld Torch Assembly. The trained models were used to forecast future spare-parts requirements by integrating operational inputs predicted using Exponential Triple Smoothing. Model performance was evaluated using statistical measures including mean squared error and coefficient of determination, demonstrating satisfactory prediction accuracy and generalization capability. The results indicate that the proposed ANN-based approach effectively supports proactive maintenance planning and data-driven spare-parts inventory management, thereby strengthening E-maintenance systems and reducing unplanned downtime.

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197 Effect of Heat Treatment and Laser Shock Peening on the Mechanical and Tribological Behaviour of Additively Manufactured AlSi10Mg Alloy

Additive manufacturing of AlSi10Mg alloy using Laser Powder Bed Fusion (LPBF) offers significant advantages for lightweight aerospace and automotive applications; however, issues such as porosity, residual stress, and poor tribological performance limit its service life. This study investigates the effect of direct aging (DA) heat treatment and laser shock peening (LSP) on the mechanical and tribological behaviour of LPBF-fabricated

AlSi10Mg alloy. Four sample conditions, namely as-built (AB), direct-aged (DA), AB+LSP, and DA+LSP, were analysed through porosity measurement, Vickers microhardness testing, tensile testing, SEM fractography, and wear analysis. The results showed that the combined DA+LSP treatment significantly improved hardness, tensile strength, ductility, and wear resistance while reducing porosity, coefficient of friction, and specific wear rate. SEM analysis confirmed improved fracture behaviour and reduced crack initiation in treated samples. Among all conditions, DA+LSP exhibited the best overall mechanical and tribological performance, demonstrating the effectiveness of combined heat treatment and laser shock peening for enhancing the reliability of additively manufactured AlSi10Mg components.

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198 CORROSION BEHAVIOR OF ADDITIVELY MANUFACTURED AlSI10mg MATERIAL

This study investigates the corrosion behavior of additively manufactured AlSi10Mg alloy under different post-processing conditions. AlSi10Mg fabricated by laser powder bed fusion often contains residual stresses, porosity, surface roughness, and microstructural heterogeneity that can significantly affect its corrosion resistance. To improve the corrosion performance of the material, heat treatment and laser shock peening were applied as post-processing techniques. The corrosion characteristics of the samples were evaluated using static immersion test, potentiodynamic polarization, and electrochemical impedance spectroscopy in 3.5 wt% NaCl solution. The study compares the as-built, heat-treated, laser shock peened, and combined heat-treated plus laser shock peened conditions to understand the influence of post-processing on corrosion rate, passive film stability, and surface degradation. The results provide useful insight into how surface and microstructural modification can improve the durability of additively manufactured AlSi10Mg components in corrosive environments.

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199 APPRECIATING AI TOOLS IN E-MAINTENANCE

E-Maintenance is an advanced maintenance approach that integrates condition monitoring, digital technologies, and data-driven analysis to improve equipment reliability, maintenance efficiency, and reduce downtime in industrial systems. With the development of Industry 4.0, Artificial Intelligence (AI) has become an important tool in maintenance activities due to its ability to analyse large volumes of sensor data, identify machine degradation patterns, and predict failures before breakdown occurs. AI-driven maintenance systems support better maintenance scheduling, reduce operational interruptions, optimize spare part utilization, and improve overall industrial productivity. This work focuses on predictive maintenance of rolling element bearings using the IEEE PHM bearing dataset for Remaining Useful Life (RUL) prediction. Bearings are critical machine components whose unexpected failure can lead to severe production losses and reduced operational efficiency. Vibration signals obtained from bearings are processed to extract important condition monitoring features such as Root Mean Square (RMS), kurtosis, skewness, variance, peak value, and crest factor for analysing bearing health conditions and degradation behaviour. These extracted features are utilized in AI-based predictive models including machine learning, deep learning, and hybrid approaches to estimate bearing degradation and predict RUL accurately for early fault detection and proactive maintenance planning. In addition to predictive maintenance, an AI-based optimization model is integrated for inventory and spare parts management to support optimum maintenance decisions, improve spare part availability, reduce unnecessary inventory costs, and minimize production downtime. The proposed AI-driven E-Maintenance framework demonstrates the capability of combining predictive analytics, condition monitoring, and intelligent optimization techniques to achieve improved equipment reliability, optimized maintenance operations, cost-effective inventory management, and enhanced industrial productivity in smart manufacturing environments.

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