

# DR. RAMAKALYAN AYYAGARI



**Date of Birth & Age** 16th January, 1969, 49 yrs  
**Present Designations** Associate Professor & Head, Computer Support Group  
**Address** Department of Instrumentation & Control Engg.  
National Institute of Technology Tiruchirappalli (NIT-T)  
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## ✚ Educational Qualifications:

S.No.	Degree	University/Institution	Year	Main Subjects
1.	Ph.D.	IIT Delhi	2000	Control Systems
2.	M.E.	Andhra University, Visakhapatnam, AP	1993	Control Systems
3.	B.E.	Andhra University, Visakhapatnam, AP	1990	Electronics & Communications Engg.

## ✚ Doctoral Thesis:

Robust Output Feedback Controllers for Nonlinear Systems, EE Dept., IIT Delhi

## ✚ Research Areas:

Core	Applications and such
1. Mathematical Control Theory, including Circuits, Signals & Systems	5. Cyber-Physical Systems
2. Numerical Linear Algebra, Data Structures & Algorithms,	6. Network Flow Control
3. Complexity Theory and Randomization	7. Modeling & Intelligent Control of Big data Systems
4. Neural Networks and Learning Algorithms	8. Path Planning Algorithms for Unmanned Vehicles

## ✚ Employment Record:

S. No.	Period of service	Designation
1.	1 <sup>st</sup> July 2009 Till date	Associate Professor, NIT Tiruchirappalli
2.	1 <sup>st</sup> July 2006 to 30 <sup>th</sup> June 2009	Assistant Professor, NIT Tiruchirappalli
3.	21 <sup>st</sup> Dec 2000 to 30 <sup>th</sup> June 2006	Senior Lecturer, REC/NIT Tiruchirappalli
4.	13 <sup>th</sup> May 1996 to 20 <sup>th</sup> Dec 2000	Lecturer, REC Tiruchirappalli

**21+ years of research, teaching, and consultancy**

## ✚ Visits Abroad:

1. Electrical & Computer Engg. (ECE) Dept., Texas A & M Univ., College Station, TX 77843 USA: from April 13 to May 9, 2008. This TEQIP I sponsored visit is upon invitation from Dr. Shankar P Bhattacharyya, Robert M Kennedy Professor, ECED, TAMU. During this period I have delivered the following lectures and initiated joint research in the area of Algorithmic aspects of PID Controller Design.”
  - i. “Mathematics of Robust Control,” Lecture to the Graduate Students
  - ii. “Robust Stability: Hermite Biehler Theorem and its Proof,” Lecture to the Graduate Students
  - iii. “A New Algorithm for Fixed Order Multivariable Controller Synthesis,” Lecture to the Research Students & Faculty
  - iv. “Stability Analysis and Control Design Using Time-Series Data,” Lecture to the Research Students & Faculty
2. University of Leicester, UK: from June 30 to July 25, 2008, and again from September 5 to 18, 2011. These visits are part of my collaborative research “Towards Reliable Smart and Adaptable Air-Vehicles” funded by British Council under the UKIERI Scheme.

## ✚ Research and Academic Contributions:

### (a) Research papers published in Refereed Journals (only recent ones, most cited)

1. [SCI] D. Ganesha Perumal, S. Seshadhri, B. Subathra, G. Saravanakumar, & **R. Ayyagari**, “MILP based autonomous vehicle path-planning controller for unknown environments with dynamic obstacles”, *Int. J. Heavy Vehicle Systems*, Vol. 23, No. 4, pp. 350-369, 2016.
2. [SCIE] S. Ismail, A.A. Pashilkar, **R. Ayyagari** & N. Sundararajan, "Diagonally dominant backstepping autopilot for aircraft with unknown actuator failures and severe winds," *The Aeronautical Journal (of the Royal Aeronautical Society, UK)*, Vol. 118, No. 1207, 2014.
3. [SCI] S. Ismail, A.A. Pashilkar, **R. Ayyagari** & N. Sundararajan, "Improved Neural-aided Sliding Mode Controller for Autolanding under Actuator Failures and Severe Winds," *Elsevier J. Aerospace Science & Technology*, Vol. 33, No. 1, pp. 55-64, 2014.
4. [SCIE] S. Seshadhri, & **R. Ayyagari**, “Advanced driver assistance system for AHS over communication links with random packet dropouts,” *Elsevier J. Mech. Systems and Signal Processing*, Vol. 49, pp. 53-62, 2014.
5. [SCIE] P. Kavitha, and **R. Ayyagari**, "Simple and Straight Proofs of Stability Criteria for LTIL Systems," *Transactions of the Institute of Measurement & Control*, Vol. 36, No. 4, pp. 523-528, 2014.
6. [SCOPUS] P. Kavitha, and **R. Ayyagari**, "A computationally faster algorithm to test the stability of characteristic polynomials," *Int. J. Systems, Control and Communications*, Vol. 5, No. 2, pp. 166-176, 2013.
7. [SCOPUS/WoS] P. Kavitha, and **R. Ayyagari**, “Computational Complexity of Kharitonov’s Robust Stability Test,” *Int. J. Control Science and Engg.*, Vol. 3, No. 3, pp. 81-85, 2013.
8. [ESCI/SCIE] S. Ismail, A.A. Pashilkar, **R. Ayyagari** & N. Sundararajan, “Neural-Sliding Mode Augmented Robust Controller for Autolanding of Fixed Wing Aircraft,” *Polish J. of AI and Soft Computing Research*, (Polish Neural Network Society) Vol. 2, No. 4, pp. 317-330, 2012.
9. [SCOPUS] S. Seshadhri, & **R. Ayyagari**, “Dynamic controller for Network Control Systems with random communication delay,” *Int. J. Systems, Control and Communications*, Vol. 3, No. 2, pp. 178-192, 2011.

10. [SCOPUS] S. Seshadhri, & R. Ayyagari, "Platooning over packet-dropping links," *Int. J. Vehicle Autonomous Systems*, Vol. 9, Nos. 1-2, pp. 46 – 62, 2011.

**(b) Research papers published in Refereed Conferences (only recent ones)**

1. [SCOPUS] Dey, Abhishek, Ramakalyan Ayyagari, "Robust PID Controller Design Using Fuzzy Pole Placement Techniques," In Proc. Fourth International Conference on Advances in Control & Optimization of Dynamical Systems, NIT Tiruchirappalli, India, 2016. This paper may be accessed on-line at <http://www.ifac-papersonline.net>, pp. 789 – 794.
2. [SCOPUS] Ambili, T.A., Ramakalyan Ayyagari, "Polynomial Modeling and Parameter Estimation of Class B Power Amplifiers," In Proc. Fourth International Conference on Advances in Control & Optimization of Dynamical Systems, NIT Tiruchirappalli, India, 2016. This paper may be accessed on-line at <http://www.ifac-papersonline.net>, pp. 314 – 319.
3. [SCOPUS] Hituraj Sahu, Ramakalyan Ayyagari, "Interval Fuzzy Type-II Controller for the Level Control of a Three Tank System," In Proc. Fourth International Conference on Advances in Control & Optimization of Dynamical Systems, NIT Tiruchirappalli, India, 2016. This paper may be accessed on-line at <http://www.ifac-papersonline.net>, pp. 561 – 566.
4. [SCOPUS] B. Sreram, Furio Buonopane, Seshadhri Srinivasan, B. Subathra, R. Ayyagari, "Verification of Design Contracts for Cyber-Physical System Design Using Evolutionary Optimization," In Proc. of IEEE Int. Conf. on Circuit, Power, and Computing Technologies (2015 ICCPCT), Nagercoil, Tamilnadu, March 19-20, 2015.
5. [SCOPUS] Shaik Ismail, A. Pashilkar, R. Ayyagari, "Phase Compensation & Anti-windup Design for Neural-aided Sliding Mode Fault-tolerant Autoland Controller," In Proc. of IEEE International Conference on Cognitive Computing and Information Processing (2015 CCIP), Noida, India, March 3-5, 2015.
6. [SCOPUS] M. Jerome Moses and A. Ramakalyan, "A Computationally Faster Randomized Algorithm for NP-Hard Controller Design Problem," In Proc. of IEEE International Symposium on Intelligent Informatics [Published in Recent Advances in Intelligent Informatics, Vol. 235 (2014), pp. 411-417, Springer-Verlag] SJCE, Mysore (2013). This paper may be accessed on-line at [http://link.springer.com/chapter/10.1007%2F978-3-319-01778-5\\_42](http://link.springer.com/chapter/10.1007%2F978-3-319-01778-5_42)
7. [SCOPUS] M. J. Moses, and R. Ayyagari, "The Benefits of Noise in Systems and Control." In Proc. of 3<sup>rd</sup> IEEE Conference on Power, Control, Signals & Computation, Thrissur, India, 2014. <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=6887486&queryText%3DThe+benefits+of+randomness+in+systems+and+control>
8. [SCOPUS] M. J. Moses, and R. Ayyagari, "A Brief Survey of Stochastic Resonance and Its Applications to Control." In Proc. Third International Conference on Advances in Control & Optimization of Dynamical Systems, Kanpur, India, 2014. This paper may be accessed on-line at <http://www.ifac-papersonline.net/Detailed/64786.html>
9. [SCOPUS] A. Pashilkar, S. Ismail, R. Ayyagari, & N. Sundarajan, "Design of a Nonlinear Dynamic Inversion Controller for Trajectory Following and Maneuvering for Fixed Wing Aircraft," presented at IEEE Symposium on Computational Intelligence for Security and Defense Applications (2013 CISDA), Nanyang Technological Univ., April 16 – 19, 2013.
10. [SCOPUS] A. Pashilkar, S. Ismail, R. Ayyagari, & N. Sundarajan, "Improved Autoland Controller for Aircraft Encountering Unknown Actuator Failures," presented at IEEE

- Symposium on Computational Intelligence for Security and Defense Applications (2013 CISDA), Nanyang Technological Univ., April 16 – 19, 2013.
11. **[SCOPUS]** V. Mishiga, S. Seshadhri, S. Ashok, S. Ramaswamy, and **R. Ayyagari**, “An Analytical Framework for Analysis and Design of Networked Control Systems with Random Delays and Packet Losses,” presented at 25<sup>th</sup> Annual Canadian Conference on Electrical & Computer Engineering (IEEE Conference), Montreal 29<sup>th</sup> April to 2<sup>nd</sup> May 2012.
  12. **[SCOPUS]** S. Seshadhri, Srini Ramaswamy, **R. Ayyagari**, N. Venkateswaran, “Hybrid Systems Approach for Networked Control Systems Subjected to Random Communication Delays,” presented at 2<sup>nd</sup> Int. Conf. on Advances in Control and Optimization of Dynamical Systems (ACODS),” IISc Bangalore, 16<sup>th</sup> to 18<sup>th</sup> Feb 2012.
  13. Shaik Ismail, A. Pashilkar, **R. Ayyagari**, “Guaranteed Stability and Improved Performance against Actuator Failure using Neural Aided Sliding Mode Controller for Autolanding Tasks,” presented at the IFAC Workshop on Embedded Guidance Navigation and Control in Aerospace (EGNCA), IISc Bangalore, 11<sup>th</sup> to 15<sup>th</sup> February 2012.
  14. **[SCOPUS]** S. Seshadhri and **R. Ayyagari**, “Consensus among robotic agents over packet dropping links,” IEEE Int. Conf. BMEI & CISP, Yantai University, Yantai, China, 16 - 18 Oct, 2010.
  15. **[SCOPUS]** S. Seshadhri and **R. Ayyagari**, “Hybrid controllers for NCSs subjected to random communication delays and packet dropouts,” Proceedings of IEEE ARTCom'09, Kottayam, Kerala, pp. 954-958, 2009.
  16. **[SCOPUS]** **R. Ayyagari**, K. Ramkumar, S. Mallikarjun, and B.V. Parvathi, “A Comparative Study of PI and Model Predictive Controllers for a Bench Mark Paper Machine Model,” Proc. of the IEEE Int. Conf. on Recent Advances in Applications of Computers in Elec. Engg. (RACE), March 2007.
  17. **[SCOPUS]** **R. Ayyagari**, K. Ramkumar, S. Mallikarjun, “Design of Fuzzy Reasoning Based Controllers for a MIMO Paper Machine Plant,” Proc. of the IEEE Int. Conf. on Recent Advances in Applications of Computers in Elec. Engg. (RACE), March 2007.
  18. **[SCOPUS]** **R. Ayyagari**, K. Ramkumar, S. Mallikarjun, and B.V. Parvathi, “Simulated Response of Neural Network Based Inverse Control of Paper Machine Plant,” Proc. of the IEEE Int. Conf. on Recent Advances in Applications of Computers in Elec. Engg. (RACE), March 2007.

**(c) Books, including a chapter in a book**

1. **Circuit Theory / Linear Electrical Networks**
  - National Mission Project on Education through ICT: Developing suitable pedagogical methods for various classes, intellectual calibers and research in e-learning.
2. S. Seshadhri and **R. Ayyagari**, “**Formation Control in Multi-Agent Systems Over Packet Dropping Links**” Eds.: Dr. J R Raol and Dr. Ajith Gopal, *Mobile Intelligent Autonomous Systems: Recent Advances*, CRC Press, USA, 2013. ISBN: 978-1-4398-6300-8
3. **Linear Circuits: Analysis & Synthesis**, Oxford Univ. Press, 2005.  
ISBN: 0 – 19 – 567001 – 0
4. **Control Engineering: A Comprehensive Foundation**, Vikas Publishing House, New Delhi, India, 2003. ISBN: 81 – 259 – 1432 – 3

#### (d) Research Projects

1. **Sponsored research projects 2015 - 2019**
  - a. Proposal titled “**Development of Modern Control Laws for a Class of Cruise Missiles**” sanctioned by DRDL Hyderabad.
  - b. Proposal titled “**De-congesting India’s transportation networks using mobile devices**” sanctioned by Information Technology Research Academy (ITRA) under the focus area Mobile Computing, Networking & Applications, to IIT Madras, IMSc Chennai, NIT Tiruchirappalli and Univ. of Calcutta.
  - c. Proposal titled “**Model Driven Engineering for Integration of Industrial Automation Systems with Application to Water Networks,**” sanctioned by ABB Global Industries and Services Ltd.
2. UKIERI (www.ukieri.org) Major Award (2007 - 2011): “Towards Reliable Smart and Adaptable Air-Vehicles.” This is a UK-India collaborative project awarded to the research group consisting of Prof. Ian Postlethwaite et. al., Control & Instrumentation Research Group at the University of Leicester, Prof. M. Seetharama Bhat, Dept. of Aerospace Engg. at IISc. Bangalore, Flight Mechanics & Control Division at the National Aerospace Laboratories (FMCD, NAL Bangalore), Prof. B. Bandyopadhyay, Interdisciplinary Programme in Systems & Control Engg., at the Indian Institute of Technology Bombay (IIT Bombay, Mumbai), and **Dr. Ramakalyan Ayyagari**, Dept. of Instrumentation & Control Engg., at the National Institute of Technology (ICE, NIT Tiruchirappalli). The total amount sanctioned to NIT Tiruchirappalli was £ 17320, equivalent to Rs. 14,00,000/-
3. Summer Research Fellowship of the Indian Academy of Sciences (2005): “Density Functional Theory and Quantum Control of Systems.” Worked at the National Chemical Laboratory (NCL) Pune with Professor BD Kulkarni.
4. Awarded **Young Scientist** by Dept. of Science and Technology (DST) under SERC Fast Track Proposals for Young Scientists 2001-02 scheme. This award carried a grant to carry out the research project “Robust and Efficient Algorithms for Modern Control Systems” during 2002-05.
5. Visited the Institute of Mathematical Sciences, Chennai from 2001-05 as an associate professor.

#### (e) Consultancy Projects

- 2006: Control Education using LabVIEW – National Instruments, Bangalore
- 2006: Middleware for protocol based supervisory control in Intelligent Vehicle Highway Systems (IVHS) – SANKHYA Technologies, Chennai

#### (f) Research Guidance @ NIT-T

1. **Ph.Ds. ongoing (registered in 2015/16)**
  - a. M.S. Thilagavathy, Full-time candidate funded by ITRA project
  - b. K. Sharmila Devi, Full-time candidate funded by the Institute
  - c. T.A. Ambili, Full-time candidate funded by ITRA project
  - d. Pranali S Tekale, Full-time candidate funded by ABB India
  - e. V.S. Murthy Arikapalli, Part-time (External) candidate from DRDL Hyderabad

2. **Ph.Ds. guided as main guide and degree awarded**

- a. S. Ismail, Fault-Tolerant Autolanding Controller using Diagonally Dominant Backstepping and Neural-Sliding Mode Augmentation, November 2014
- b. P. Kavitha, A Study on the Proofs and Computational Complexity of Stability Criteria in Control Engineering, September 2013
- c. N. Raju, Analysis of Welding Distortion using Strain Gauge based Instrumentation System, December 2010
- d. S. Seshadhri, Estimation & Design Methodologies for Networked Control Systems with Communication Constraints, PhD Awarded in December 2010

3. **PhDs. guided as co- guide and degree awarded**

- a. B. Vasuki, Analysis of Uncertainty for Instrumentation Systems using Interval Methods, December 2009

4. **M.S./Research Projects:**

- a. T. A. Ambili, Electronic Circuit Design from a Control Systems Perspective, August 2016
- b. Jerome M Moses, Stochastic Resonance and Applications in Control Systems, July 2014

5. **Number of significant M.Tech Projects guided: 18**

✚ **International Workshops participated on invitation recently (only major ones cited)**

1. "Human Cyber Physical System Interaction: Control for the Human Welfare," IFAC & IEEE-CSS sponsored International Workshop, Paris, Sept 22-23, 2014.
2. "Workshop on Probability and Stochastic Processes in Engineering," EE Dept, IIT Bombay, March 11-15, 2013.

✚ **Invited Lectures Delivered @**

1. Workshop on Advances and Success Stories of Robust & Adaptive Control, Dept of Aerospace Engineering, **Indian Institute of Science, Bangalore**, September 8-9, 2017.
2. Invited talk at IDRBT, Hyderabad, May 27, 2017.
3. Invited talk at ABB, Bangalore, March 16, 2017.
4. TEQIP funded Faculty Development Programme, Dept. of EEE, **NIT Calicut**, Jun-July, 2016.
5. Workshop on Nature Inspired Computing in Engg Appls, **IISc., Bangalore**, April 6-8, 2015.
6. TEQIP funded Faculty Development Programme, Dept. of EEE, **NIT Calicut**, Dec 2013.
7. TEQIP funded Faculty Development Programme, Dept. of ICE, PSG Institute of Technology, Coimbatore, November 2013.
8. Certificate Course on Advanced Control Engineering for the Scientists of **DRDL Hyderabad** (8 lectures), Jan - Mar, 2013.
9. UKIERI workshop **NAL Bangalore**, December 2011.
10. UKIERI Symposium, Dept. of Engg., **Univ. of Leicester, UK**, Sept 2011.
11. UKIERI workshop **IIT Bombay**, December 2010.
12. AICTE Course on Biomedical Systems, ICE Dept., NIT-T, July 2010.
13. UKIERI workshop NIT-T, Dec 2009.
14. Challenges in Control Engineering Workshop, NIT-T, Jan 2009.
15. Invited Lecture, Aerospace Engineering Dept, **IISc Bangalore**, Oct 2008.
16. UKIERI workshop **IISc Bangalore**, August 2008.
17. UKIERI Symposium, Dept. of Engg., **Univ. of Leicester, UK**, July 2008.

18. AICTE sponsored Short-Term Course on Process Identification & Control, Dept of Chemical Engg. , NIT-T, June 2008 (2 lectures).
19. **Texas A&M University, USA**, April 2008 (4 lectures).

#### **Conferences Organized**

1. General Chair, 4<sup>th</sup> IFAC Conference on Advances in Control & Optimization of Dynamical Systems (ACODS), Feb 1-5, 2016, NIT Trichy.
2. Convener, ICECON 2009
3. Organizing Secretary, ICECON 2007
4. Founder Organizing Secretary, "National Conference on Instrumentation & Control Engineering (ICECON)," 4<sup>th</sup> to 6<sup>th</sup> Dec 2003

#### **Courses/Workshops organized as a coordinator**

1. Workshop on Innovative & Sustainable Chemical Process Analysis, Design and Synthesis, NIT Trichy, Aug 28 to Sep 1, 2017.
2. ACDOS Workshop "Emerging Avenues in Advanced Control," NIT Trichy, Oct 17, 2015
3. TEQIP – II sponsored workshop "Flight Mechanics, Guidance, & Control," Nov 5-6, 2015.
4. TEQIP – II sponsored workshop "Data Based Analysis & Synthesis of Linear Systems," Prof. Shankar P Bhattacharyya Festschrift, Dec 31, 2013.
5. TEQIP - II sponsored workshop "Perspectives on Curriculum," May 9-10, 2013.
6. Certificate Course on Advanced Control Engineering for the Scientists of DRDL Hyderabad (8 lectures), Jan - Mar, 2013
7. ACDOS Workshop "Fascinating and Challenging Applications of Estimation," NIT Trichy, Nov 10-11, 2011
8. AICTE FDP on Trends in Biomedical Engineering, 28<sup>th</sup> June to 3<sup>rd</sup> July, 2010
9. UKIERI funded Programmes organized at NIT Trichy and elsewhere
  1. UKIERI workshops @
    - a. NAL Bangalore, December 2011
    - b. University of Leicester, September 2011
    - c. IIT Bombay, December 2010
    - d. NIT Trichy, December 2009
    - e. IISc Bangalore, August 2008, August 2007
    - f. University of Leicester, July 2008
  2. Challenges in Control Engineering, NIT Trichy, January 8-10, 2009
10. IEEE workshops on Robotics and Machine Intelligence, and Linux done every semester

#### **Membership in Professional bodies**

1. The Institution of Electrical & Electronics Engineers (**IEEE**), USA – **Senior Member**
2. The Society for Industrial & Applied Mathematics (**SIAM**).
3. The Automatic Control & Dynamic Optimization Society (**ACDOS**, an affiliated National Member Organization of the International Federation of Automatic Control (**IFAC**)); Founder secretary 2011 – 14, Vice-President 2014-16, and President 2016 – 18.

## ✚ Other information:

- **Co-curricular and Professional Development related activities**

1. Conceived and nurtured Carnatic Music Club called AMRUTHAVARSHINI and organized Thyagaraja Aradhana for 5 consecutive years from 2006 to 2010.
2. Has been staff advisor for IEEE Student chapter since 1999, for Linux Users Group since 2004, and for Robotics & Machine Intelligence club since 2008.
3. Was a staff advisor for ACM Student chapter and E-cell during 2005 – 2007
4. Held the position of Associate Dean R&C from Sept 1, 2008 to Nov 30, 2009
5. Held the position of Head of the Department for 3 years from December 1, 2009 to November 30, 2012.
  - Instrumental in streamlining the activities of the department and simplifying the procedures
  - Purchased equipment worth approx. Rs. 1 Crore in addition to the DST-FIST funding.
  - Architect of Industry-taught courses (core and elective)
  - Motivated ministerial staff in organization, productivity, and delivery
6. Serving on routine administrative committees
7. Presently heading the Computer Support Group, the IT hub of NIT Trichy. The projects I handle are to the tune of Rs. 12 crore as on date.

- **Other interests:**

- Mathematics & Science Education
- Classical Music (Carnatic and Western)
- Reading

## ✚ References:

1. Dr. Abraham T Mathew  
Professor, EE Dept.,  
National Institute of Technology Calicut  
KOZHIKODE, 673 601, Kerala INDIA  
**Email: atm@nitc.ac.in**  
**Tel: +91 – 495 – 2297 – 396**
2. Dr. Shankar P. Bhattacharya  
Robert M Kennedy Chair Professor,  
216R Zachry Engineering Center  
EE Dept., Texas A & M Univ., College Station USA TX 77840  
**Email: spb@tamu.edu**  
**Tel: +1 – 979 – 845 – 7484**

All the data furnished in this curriculum vitae pp. 1 – 8 are true to the best of my knowledge.



NIT Trichy, January 31, 2018



## Statement on Research and Teaching

My doctoral work at IIT Delhi was in the broad area of Robust Control. After a short stint with simulation studies using Neural Networks and Fuzzy Logic, I preferred to switch over to a more rigorous approach of applying game theory to control problems in nonlinear systems. I succeeded in my attempt to integrate the measures of robustness (the  $H_\infty$ -norm), and intelligence (the reinforcement learning), in the game theoretic setting.

Dynamic Programming was an integral part of my thesis and working extensively on this goaded me to look at the “computational” issues. Soon after my thesis, I started looking at the controller design problems from a computational complexity point of view and discovered certain interesting issues; for instance, the pole placement problem (full state feedback control) in linear systems with constraints is *NP hard* (it may take ages to arrive at a satisfactory design), and the complexity of simple and the most popular output feedback control problem is unknown. This problem is still in the list of open problems in Systems & Control. Complexity theory provides a rigorous mathematical framework to study such problems and prompts us to invent computationally tractable algorithms. This line of research is very pragmatic since computation is now regarded as an equal and indispensable partner along with theory and experiment in engineering practice. In the year 2001 I was invited to visit the Institute of Mathematical Sciences Chennai, as an associate professor. This institute has provided facilities for my carrying out this research for three years. Towards late 2002, the Department of Science & Technology (DST, GoI) has approved my proposal for further research in this direction on a larger scale and funded me under its Young Scientists scheme. Since then I have been working towards developing computationally efficient control algorithms. This bringing together control systems and complexity theory of computer science is has been scintillating, and all of my learning and current research has been pivoted on this.

In May 1996 I joined the National Institute of Technology at Tiruchirappalli as a lecturer in the fledgling department of Instrumentation and Control Engineering. Owing to the wider spectrum of courses offered here, I was assigned to devise the “Control Stream” with core courses - MATHEMATICS, NETWORK THEORY, SIGNALS AND SYSTEMS, MICROELECTRONICS, OPERATIONAL AMPLIFIERS, CONTROL SYSTEMS, DATA STRUCTURES AND ALGORITHMS, and MODERN CONTROL THEORY (in that order, semester-wise), and related electives like ROBOTICS, NONLINEAR CONTROL, AUTOMOTIVE CONTROL SYSTEMS, INTELLIGENT CONTROL, COMPUTATIONAL TECHNIQUES IN CONTROL ENGG., PROBABILITY & COMPUTING, and COOPERATIVE CONTROL. Most of these courses are regularly offered by me. I also had an opportunity to be the founder-convener for the department's library and the computer center.

Over the years this stream has evolved quiet well with a rich blend of mathematical rigor and physical intuition. I have also developed four core laboratories primarily for the undergraduate students: DEVICES & CIRCUITS (III Semester), ELECTRONIC CIRCUITS (IV Semester), ANALOG INTEGRATED CIRCUITS (V Semester), and CONTROL ENGINEERING (VI Semester) where low cost electrical network elements and hands-on experimentation are preferred to expensive demonstration modules. One of the interesting experiments is the non-inverting Deboo Integrator during V and VI semesters. This practice has been well received since it enables the student to apply the theory verbatim and conduct an *experiment* rather than simply *demonstrate*. There are several masters' and doctoral students who work in these laboratories for enriching their fundamentals. Using the resources of these laboratories I guide students in designing and developing low-cost self-navigating mobile robots. I am also the faculty advisor for the Robotics & Machine Intelligence (RMI) club under the

IEEE student chapter. A few of the recent projects include an all-terrain vehicle, self-balancing bicycle, and a virtual xylophone. These activities have been much sought after in the campus, motivating several students into pursuing research in the USA, the UK, and Australia. In turn this motivates me to nurture the student community here. I have summarized my experiences, partly in teaching and partly in research, and authored two textbooks titled CONTROL ENGINEERING: A COMPREHENSIVE FOUNDATION and LINEAR CIRCUITS: ANALYSIS AND SYNTHESIS.

Post 2005, NIT Tiruchirappalli added research to its otherwise teaching agenda. Continuing with my research in computational complexity for practical control systems, I have collaborated with the Dept. of Aerospace Engg., Indian Institute of Science Bangalore in 2007. Our joint proposal "Towards Reliable Smart and Adaptable Air-Vehicles" was granted major award by the British Council under its maiden UKIERI scheme 2007-11. This was one of the 7 proposals (among sciences, engineering, medicine and so on), and the only NIT, to get this major grant. In addition to IISc Bangalore, I had an opportunity to work closely with the research groups at the University of Leicester (UK), IIT Bombay, and National Aerospace Laboratories (NAL) Bangalore. In particular, I contributed to the design and analysis of path planning algorithms for UAVs and certain on-board electronics for mini and micro air-vehicles. As a part of this project I guided a PhD in the broad area of Networked Control Systems. This was my getting into the field of cyber-physical systems.

During January-March 2013, I have conducted a Certificate Course in Advanced Control Engineering for the scientists at DRDL Hyderabad, tailored to their research activities. As a part of this course I taught topics, such as State-space controller design, Optimal Control & Dynamic Programming, Computational Techniques, and Kalman Filters, which were well received by the participants. Currently I am involved in a project on developing modern control laws for a class of cruise missiles.

In summary, all through I have been quite proactive in the academic activities, albeit an initial emphasis on undergraduate teaching, pertinent to my parent institution. I strengthened myself in peer-networking over years. I have healthy professional relationship with several universities in India and abroad. I have also established contacts with the industry – ABB, BHEL, DRDL, GTRE, GE, and Honeywell. At present, I have a funded project from ABB on Model Driven engineering and application to water networks. I am also involved in conducting certificate courses for ABB. And, I have a joint project titled Decongesting India's Transportation Networks using Mobile Devices, funded by ITRA (under the current focus area Mobile Computing, Networking & Applications) along with IIT Madras, IMSc Chennai, and University of Calcutta.

All along, in the 20+ years of my service here, there was no compromise on the quality of education I have imparted to the students, both undergraduate and graduate. It has been a source of deep inspiration and immense satisfaction receiving periodic mails of appreciation from my passed-out students who stand witness to my mentoring. I look forward to taking up more exciting projects both in theory and in practice that would enrich my learning, and consequently allow me to work for the welfare and growth of the society around me.

