



SHORT TERM COURSE III

On

A New Cooperative Wireless Strategy: Soft Information Forwarding

(28/04/2021 to 10/05/2021)

Sponsored by:
Scheme for Promotion of
Academic and Research
Collaboration (SPARC)

Organized by:
Department of Electronics and
Communication Engineering,
NIT Tiruchirappalli, India

Collaboration with:
National Research Tomsk
Polytechnic University,
Russia

About SPARC:

Scheme for Promotion of Academic and Research Collaboration (SPARC) is a Ministry of Human Resource Development (MHRD), GOI initiative to improve research ecosystem in India. It supports national premier educational institutions by facilitating academic and research collaborations between Indian institutions and the best and selected institutions across the world's 28 nations. It encourages international faculty, Indian institution visits and long-term stays to teach courses and conduct workshops for the benefit of Indian researchers and students in the selected research area.

About TPU- Russia:

The Tomsk Polytechnic University (TPU), Russia is ranked at 387 in QS world rank and is ranked as 10th in Russia. It has 277th place in the world in the direction of "Engineering and Technology" as of QS ranking and 201-250 place in the world in the discipline "Engineering: mechanics, aviation, production" and Chemistry. TPU is the first engineering school in Russia's Far East to open doors in 1896. Today TPU is one of Russia's leading public research universities with focus on applied science and technology. TPU is a research university with a strong tradition of excellence in the areas of physics, applied engineering, and electronics engineering. Recently, we added nanotechnologies and alternative energy to our research portfolio. Tomsk Polytechnic's annual research budget of \$30 million ranks second among technical and engineering schools in the country. Roughly 10% of funding comes from outside Russia; we rank second to none in this category.

Key Resource Person:

Prof. DUSHANTHA NALIN K JAYAKODY,



(S'09, M'14, SM' 18) received the Ph. D. degree in Electronics, Electrical, and Communications Engineering, from the University College Dublin, Ireland in 2014. He received his MSc degree in Electronics and Communications Engineering from the Department of Electrical and Electronics

Engineering, Eastern Mediterranean University, Turkey in 2010 (under the University full graduate scholarship). From 2014 - 2016,

he was a Postdoc Research Fellow at the Institute of Computer science, University of Tartu, Estonia and Department of Informatics, University of Bergen, Norway. From 2016, he is a Professor at the School of Computer Science & Robotics, National Research Tomsk Polytechnic University (TPU), Russia.

Prof. Jayakody has published over 120 international peer reviewed journal, conference papers and books. His research interests include PHY and NET layer prospective of 5G communications technologies such as NOMA for 5G etc, Cooperative wireless communications, device to device communications, LDPC codes, Unmanned Ariel Vehicle etc. Prof. Jayakody is a Senior Member of IEEE and he has organized or co-organised more than 20 workshops and special sessions of various IEEE conferences. He also served as chair, session chair or technical program committee member for various international conferences, such as IEEE PIMRC 2013-2019, IEEE WCNC 2014-2018, IEEE VTC 2015-2018 etc. He currently serves as an Area Editor the Elsevier Physical Communications Journal, MDPI Information journal and Wiley Internet of Technology Letters. In his career, so far, he has attracted nearly 6M \$ research funding. Also, he serves as a reviewer for various IEEE Transactions and other journals.

Eligibility:

The programme is open to UG, PG and Ph.D. Scholars of Electronics and Communication Engineering and allied disciplines of National Institute of Technology, Tiruchirappalli.

Course Coordinators:

Dr. P. Muthuchidambaranathan, Professor, ECE Dept.

Dr. G. Lakshmi Narayanan, Professor, ECE Dept.

Dr. G. Thavasi Raja, Assistant Professor, ECE Dept.

Dr. Patil Ashish Anand Rao, PDF, ECE Dept.

Last date of Registration 27.04.2021

For any clarifications, please contact:

Mr. Anandpushparaj. J, Mobile: 9092085186

Mr. Dilip, Mobile: 8978827935

Mail id: anandece1989@gmail.com

To Register click on the below link :

https://docs.google.com/forms/d/e/1FAIpQLSdeXqTdp2Rq9fyOPpMzjxLvFJ3FcP5RrkVF6ZRaE2uoeRrlw/viiewform?usp=sf_link

SPARC Project Code – 145, Self-Energised UAV-assisted Communications for 5G Wireless Networks

Course Outline

Name of course:	A New Cooperative Wireless Strategy: Soft Information Forwarding
Course level:	PG (any year)
Instructor:	Prof. Dushantha Nalin K. Jayakody
Teaching Assistants	Tharindu Ponnimbaduge Perera(TPU) and AnandPushparaj J. (NIT-T)
Discipline:	Electronics & Electrical Engineering/ Telecommunications Engineering
Lecture hours:	14 hrs
Pre-requisites:	Module on Digital Communications

Course Description:

The next generation of wireless networks are aimed to have high data rate, improved system spectral efficiency (data volume per area unit), low energy consumption, low outage probability, high number of supported devices and less infrastructure deployment costs. In order to meet some of these objectives, cooperative relaying has been developed and nourished over the last decade. This module presents novel research results on the design and performance evaluation of the coded and un-coded soft information relaying (SIR) relay protocol. Special attention in this module will be given to the detection problem of the soft decode and forward (SDF) scheme. A novel method will be studied to compute the log-likelihood ratio (LLR) of the received signal at the destination, which we refer to as the soft scalar model. We also propose a novel method for soft re-encoding with low computation complexity. This relay protocol is known as the soft decode compress and forward. The proposed system provides a means of using LDPC coding in conjunction with higher order (M-ary PAM and QAM) modulation, which is effective even under poor source-relay link conditions.

Learning Outcomes

- 1: Explain the basic introduction to cooperative systems in general and typical application scenarios of cooperative techniques.
- 2: Critically analyses the regenerative, transparent and other competitive relay schemes. This is pivotal in understanding and quantifying the performance of cooperative protocols at the physical (PHY) layer.
- 3: Quantify the performance of soft information relaying
- 4: Explain soft relaying models and integration of this scheme to the future wireless schemes. systems

Lecturer Hrs – 12 (28/04/2021 to 10/05/2021)

Course Contents (# of lecture hours)

Topic	Contents	# of hours
1	Introduction to cooperative wireless communication	1
2	Cooperative performance bounds	1
2	Introduction to regenerative relay system	1
3	Introduction to transparent relay system	1
4	Soft information relaying	2
5	Soft Forwarding with network coding for cooperative relay system	1
6	Soft network coded multilevel forwarding scheme	2
7	Would soft information form part of 6G!	1
8	Cooperative performance bounds	2

Assessment

- **By attendance 40%**
- **End of the module exam or project 40%**
- **Quizzes 20%**

Reference:

1. Liu, K., Sadek, A., Su, W., & Kwasinski, A. (2008). Cooperative Communications and Networking. Cambridge University Press. Doi:10.1017/CBO9780511754524
2. Dushantha Nalin K. Jayakody, Mark F. Flanagan, "A Soft Decode-Compress-Forward Relaying Scheme for Cooperative Wireless Networks", IEEE Transactions on Vehicular Technology, vol. 65, pp. 3033 - 3041, June 2015.
3. Dushantha Nalin K. Jayakody, Jun Li, Mark F. Flanagan, "A Soft-Network-Coded Multilevel Forwarding Scheme for Multiple-Access Relay Systems", IEEE Transactions on Vehicular Technology, vol. 65, pp. 3430 - 3439, June 2015