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# DEBARATI SEN

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## SYNOPSIS

**Electronics & Telecommunication Engineer** with more than 12 years of **Academic, Research, Industrial** experience. Research interest lies broadly in the following areas :

- Wireless Communication Systems
- Optical Communication Systems

## CAREER HIGHLIGHTS

- ⇒ EDUCATION : Ph.D. (Telecommunication Engineering) from IIT-Kharagpur, India
- ⇒ PROFESSIONAL INVOLVEMENT :
  - Sr. Chief Engineer, Samsung Research, Bangalore, India
  - Postdoctoral Research Fellow, Chalmers University of Technology, Sweden
- ⇒ ACADEMIC AWARDS :
  - National Doctoral Fellowship, MHRD, Govt. of India
  - University Gold Medal from IEST, Howrah (formerly BESU, Shibpur, Howrah)
- ⇒ PROFESSIONAL AWARDS :
  - DAAD-IIT Faculty Exchange Fellow, Technical Univ. Munich, Germany
  - Young Engineers Award, IE(India)
- ⇒ RESPONSIBILITIES :
  - Editorial Board Member of two International Journals
  - IEEE Kharagpur Chapter (R10) – Vice Chair (2019), Secretary (2018)
- ⇒ EXPERIENCES (Years/Months) : Teaching (09/00); Research / Industrial (03/10)
- ⇒ PROJECTS INVOLVED : Ongoing – 07; Completed – 12
- ⇒ PUBLICATIONS : Journal Papers – 31; Conference Papers – 51; Patent Applications – 12
- ⇒ THESIS GUIDANCE : Ph.D. – 1 (Awarded), 13 (Ongoing); Masters' – 18 (Completed & Ongoing)

## KEY DELIVERABLES

### EDUCATION

- Ph.D. (Telecommunication Engineering) June 2010  
Indian Institute of Technology Kharagpur, India  
Advisor : Prof. S. Chakrabarti Co-advisor : Prof. R. V. Raja Kumar  
Thesis : Efficient Timing and Frequency Synchronization for Multi-Band OFDM based Ultra-Wideband Systems
- M.E. (Electronics and Telecommunication) October 2004  
IEST, Shibpur, Howrah, India (Formerly BESU)  
Advisor : Prof. D. Mukherjee Co-advisor : Mr. K. Dasgupta (CGCRI, Kolkata)  
Thesis : Studies on EDFA related to WDM Applications and Measurement of Some Essential Parameters

### AWARDS & DISTINCTIONS

- Qualcomm Innovation Fellowship, India (2017)
- 'Honorable Mention Award' at IEEE ANTS 2016, Bangalore, India (2016)
- DAAD-IIT Faculty Exchange Fellow, Technical University of Munich, Germany (2014)

- IETE N V G Memorial Award (2013)
- 'Best Paper Award' at Samsung Tech. Conference, Seoul, South Korea (2010)
- IE(I) Young Engineers Award (2010)
- 'Award of Excellence' at Samsung Research, Bangalore, India (2010)
- 'Spot Award for Excellence in Research' by Samsung Research, Bangalore, India (2010)
- National Doctoral Fellowship (NDF) of AICTE, Govt. of India (2006 – 2009)
- Young Scientist Travel Support by DST, Govt. of India (2008)
- Doctoral Fellowship, Ministry of HRD, Govt. of India (2005 – 2006)
- University Gold Medal from IEST, Howrah (Formerly BESU) (2004)
- National Scholarship Certificate by Govt. of India for Secondary Board Examination (1991)

## PROFESSIONAL RESPONSIBILITIES AND DELIVERABLES

- Editorial Board Member of Inter. Journals : IJUWBCS by Inderscience Publishers (Since 2008)  
Proceedings of Open Library of Engg. Sciences (POLES) (Since 2013)
- Warden (2019 – Till Date), Asst. Warden (2013 – 2018) of SN/IG Hall of Residence at IIT-Kharagpur
- Faculty Coordinator for Grenoble – INP Ensimag (France), Office of IR, IIT-Kharagpur
- IEEE Kharagpur Chapter (R10) : Vice Chair (2019), Secretary (2018), Treasurer (2017), Asst. Secretary (2016)
- Member, Crèche Management Committee, IIT-Kharagpur
- Reviewer, Scheme for Promotion of Academic and Research Collaboration (SPARC), MHRD, GoI (2019)
- Member, Board of Studies, RV College of Engineering, Bangalore (2018 – 2021)
- Member, Mentor Council for NCVT courses, Ministry of Labour & Employment, Govt. of India (2014 – 2015)
- Divisional IP Coordinator, Samsung Research, Bangalore, India (2013)
- Member of Strategic Planning Core Group, SISO, Samsung, Bangalore, India (2010 – 2011)
- TPC Co-Chair, NCC 2020, Kharagpur (Feb., 2020)
- TPC Co-Chair, IEEE ICIIS 2019, Peradeniya, Sri Lanka (Dec., 2019)
- Publication Co-Chair, IEEE ANTS 2015, Kolkata (Dec., 2015)
- Session Chair of IEEE Conferences : GLOBECOM- 2018, 2015, 2011, 2010, VTC- 2017(S), 2011 (S), PIMRC- 2015
- TPC Member of IEEE Conferences : ICC- '19 – '10; GLOBECOM- '19 – '10; VTC- '16 (S), '12 – '10; PIMRC- '19 – '08

## MEMBERSHIP

- Senior Member, IEEE USA
- Fellow, IE(India)

## EMPLOYMENT

- Indian Institute of Technology, Kharagpur, India  
Associate Professor, G. S. S. School of Telecommunications Since May 2019  
Assistant Professor, G. S. S. School of Telecommunications June 2013 to May 2019
- Samsung Research, Bangalore, India  
Sr. Chief Engineer, Frontier Research Group April 2012 to May 2013
- Chalmers University of Technology, Gothenburg, Sweden  
Postdoctoral Research Fellow, Dept. of Signals and Systems Feb. 2011 to Feb. 2012

- Samsung India Software Operations, Bangalore, India  
Chief Engineer, Network & OS Part May 2009 to Jan. 2011
- St. Thomas' College of Engineering & Technology, Kolkata, India  
Lecturer, Dept. of Elect. & Comm. Engg. July 2002 to July 2005

### SUBJECTS TAUGHT / TEACHING

- At the Undergraduate (B.Tech) level at IIT-Kharagpur and STCET, Kolkata :
  - (a) Modern Digital Communication Techniques, (b) Analog Communications, (c) Digital Communications, (d) Digital Electronics & Logic Design, (e) Introduction to Wireless Communications
- At the Postgraduate (M.Tech / Ph.D) level at IIT-Kharagpur :
  - (a) Telecommunications Network Planning & Management, (b) Spread Spectrum Communications and Jamming, (c) Communications Signal Processing and Algorithms (d) Signaling and Communications for Railway Engineering

### COURSEWARE DEVELOPMENT & SHORT TERM COURSE ORGANIZED

- Developed Web Course on 'Spread Spectrum Communications and Jamming' under the MOOC Project, Ministry of HRD, Govt. of India for Teachers and Students in the discipline of Electronics & Comm. Engineering
- Developed Course Work on 'Communication Systems for Programmable Electronic Systems' under the Consultancy Project for Setting up of Centre for Safety Critical Software for Signaling Applications at IRISSET, Ministry of Railways, Govt. of India
- Organized Short Term Course on 'Recent Advancements in Short Range Wireless Communications' under TEQIP Program for Teachers and Persons from R&D Organizations (July 11-15, 2016)

### RESEARCH AND ACADEMIC PROJECT GUIDANCE

- Post-Doctoral Level : 01 (In progress)
- Doctoral Level : 01 (Awarded) 13 (In progress)
- Masters Level : 12 (Completed) 06 (In progress)
- Bachelors Level : 14 (Completed) 01 (In progress)

### RESEARCH INTERESTS

- Wireless Communication Systems : 5G Communications; Millimeter Wave Comm.; Large MIMO Systems;  
Short Range Comm.; Green Communications; Cloud RAN;
- Optical Communication Systems : Coherent Optical Communication

### PRESENT RESEARCH HIGHLIGHTS

#### ▪ Millimeter Wave Communications :

Millimeter wave (mmWave) bands are envisaged to be utilized for ultra-high data rate communications for 5G and beyond due to availability of large bandwidths. It poses a multitude of challenges pertaining to the high frequency of operation of devices and circuits coupled with the unique multi-path characteristics of mmWave channel. At one end, directional communication is a key element for the sustenance of high speed links (tens of Gbps) in mmWave that can be realized using antenna beamforming. On the other hand, energy efficient system and protocol design is of prime importance in view of green communication for next generation. Our specific contributions in this field are energy efficient radio architecture and Medium Access (MAC) protocol design, mmWave channel modeling using stochastic geometry, and devising fast beamforming algorithms.

- ⇒ **Energy efficient radio architecture design** : Proposed a new sub band based radio architecture for 60 GHz communications which addresses power efficiency by reducing the sampling rate requirement in ADC. The design yields a power savings of 24% as compared to IEEE 802.11ad system with comparable data rates.
- ⇒ **Energy efficient MAC protocol design** : A novel optimization framework for energy efficient centralized scheduling on a time slot basis by defining link level energy efficiency as the ratio of link level throughput to corresponding power consumption has been proposed. It offers significant improvement both in terms of energy efficiency and delay fairness.
- ⇒ **Channel model using stochastic geometry** : Proposed a geometry based channel model with first and second order reflection processes using stochastic geometry. Obtained a tractable model for understanding the joint impact of transmission distance, antenna half power beamwidth, and antenna beam pointing angle.
- ⇒ **Beam-Forming Algorithm Design** : Based on the classical Rosenbrock's numerical direct search method, proposed a threshold acceptance feature augmented with a divide-and-conquer strategy and Direction of Arrival aided initialization, to provide resilience to link blockage and enhance the search success performance, respectively. It yields a high search success percentage with fast convergence, ease of implementation applicable to generic phased array.

#### ▪ **Large and Distributed MIMO Systems :**

Distributed as well as collocated massive multi input multi output (massive MIMO) systems are considered as key enabler for increasing spectral efficiency, coverage area and user densification in 5G and beyond wireless communication systems. However, a few challenging issues in practical deployment of massive MIMO networks with coherent communication are synchronization, tracking of independent oscillators and channel estimation along with energy efficient baseband algorithm designs. A large MIMO network also suffers from fundamental difficulty of efficient resource allocation. In this context, our key contributions lie in design of joint time, frequency and channel estimation techniques, channel estimation in presence of pilot contamination in multiuser environment, energy efficient training sequence design and optimal resource allocation with user scheduling by game theoretic approach.

- ⇒ **Joint Time, Frequency Offset and Channel Estimation** : Proposed a semi-blind joint estimation of time, frequency and channel to attain distributed coherence using sufficient statistics of data symbols along with limited pilot symbols to obtain improved performance. Further, a semi-blind algorithm for full duplex two-way relay system that encompasses the effect of residual self-interference in the joint estimation method, attains higher spectral efficiency, and converges in single iteration has been proposed.
- ⇒ **Channel Estimation in Presence of Pilot Contamination for Large MIMO** : Proposed a semi-blind iterative pilot-based space-alternating generalized expectation maximization (SAGE) based channel estimator that consumes reasonably less time compared to ML estimate with stable convergence. It efficiently regains the loss of spectral efficiency involved in pilot-based SAGE estimator.
- ⇒ **Training Sequence Design for Joint Frequency Offset and Channel Estimation** : Proposed two optimal design of Training Sequences for both channel and frequency offsets estimation in spatially correlated environment of large distributed antenna system by minimizing derived hybrid Cramer-Rao lower bound under the overall and individual (at node) power constraint. The designed sequences are short in length, and hence, spectrally efficient.
- ⇒ **Optimal Resource Allocation and User scheduling using Game Theory** : Game theory is a powerful tool for the design and control of multi-agent systems, which provides a distributed learning algorithm to attain Nash equilibrium for the agents. We have proposed a quality of experience based decentralized optimization with local information. The proposed state based game for the resource allocation and user scheduling uses the gradient play algorithm to obtain the optimal solution.

▪ **Intelligent Vehicular Communication Network :**

New architectures, protocols and implementations of vehicular ad-hoc network (VANET) have been made in recent years to provide Intelligent Transportation Services. In intelligent transportation systems (ITS), each vehicle takes on the role of sender, receiver, and router to broadcast information to the vehicular network or transportation agency, which then uses the information to ensure safe, free-flow of traffic for a V2X (vehicle to any network) infrastructure. In this context, our specific contribution are in the design of algorithms to estimate Doppler frequency shift, devising channel estimation methods over two way relay networks, and novel distributed radio network architecture design.

- ⇒ **Algorithm design for estimation of Doppler Shift :** One of the key problems in high speed ITS network is signal degradation due to Doppler shift, which in turn is caused by the high velocity of transmitter and receivers. A high Doppler shift (e.g., 4.9 kHz/s in current systems when the train passes by a base station) will be detrimental to the orthogonal frequency division multiplexing (OFDM) based 5G system, as OFDM is very sensitive to large Doppler shift. To improve the estimation performance of Doppler frequency shift, a maximum a posteriori estimator (MAPE) is proposed which takes the estimation of radio environment map (REM) as a priori knowledge and exploits the cyclic prefix (CP) structure of OFDM to provide a maximum a posteriori (MAP) estimation.
- ⇒ **Channel estimation in Two way Relay Networks for ITS :** Successful reception of information over intelligent transport network will largely depend upon efficient channel estimation specially on a relay based network with two way communication. We came up with a semi-blind space alternating generalized expectation (SAGE) based fast converging channel estimation mechanism that addresses the self-interference issue of two way communication in a high speed vehicular network.
- ⇒ **Fog based delay tolerant network architecture design :** In order to establish efficient V2X communication system for future, a novel fog based network backbone architecture has been proposed to address the delay critical traffic of high speed VANETs. The structure addresses efficient load balancing between fog and cloud network, network slicing, advanced scheduling and front haul compression techniques in addition to delay sensitivity issue for 5G and beyond.

**PUBLICATIONS**

- Patents : 12 (Published / Filed)
- Book Chapters : 02 (Published)
- Technical Document : 01 (Published)
- Journal Papers : 31 (Published in International Referred Journals)
- Conference Papers : 51 (Published in Proceedings of International Conferences)

**SIGNIFICANT PUBLICATION DETAILS**

**PATENTS**

- Method and System for joint Training Sequences design for correlated Channel and Frequency Offset Estimation (US Patent Publication # **20190068426 A1**, Feb 28, 2019), by Chakraborty S., [Sen Debarati](#) (2019)
- Wideband electromagnetically coupled microstrip patch antenna for 60 GHz millimeter wave phased array panel, (IPR & IR Cell, IIT-Kharagpur ID # **21470**, Jan 18, 2019), by Ghosh S., [Sen Debarati](#) (2019)
- A Method and System for Frequency Estimation using Modified MUSIC with Reduced Sample Size, (IPR & IR Cell, IIT-Kharagpur ID # **21341**, May 26, 2017), by Mankar P. D., [Sen Debarati](#), Ray P. (2017)
- Method and Apparatus for Timing Synchronization at Sub-sampled rate for Sub-sampled Wideband Systems, (US Patent Grant # **9054905 B2**, June 09, 2015), by [Sen Debarati](#), Bynam K., Nair J. P., Naniyat A. (2015)

- Method and System for Handling Interference Between a Low Power Network and a High Power Network Sharing a Common Frequency Band, (US Patent Publication # **20140328194 A1**, Nov. 06, 2014), by Sen Debarati, Patro R. K., Thejaswi P. C. (2014)
- System and Method for Sub-sampled OFDM based Sub-band Wideband for Energy Efficient UWB and 60GHz Communications, (Indian Patent Publication # **18/2013**, May 03, 2013), by Nair J. P., Sen Debarati, Jos S., Naniyat A. (2013)
- Timing Synchronization Method and Apparatus in a Wireless Communication System, (US Patent Grant # **8433012 B2**, April 30, 2013), by Sen Debarati, Nair J. P., Jos S., Naniyat A. (2013)
- Method and Apparatus for Generating Multiple Sets of Codes for Spread Spectrum based Communication Systems, (Indian Patent Publication # **43/2012**, Oct. 26, 2012), by Jos S., Nair J. P., Sen Debarati, Naniyat A. (2012)
- Methods and Devices for Handling Inter-Symbol Interference in a Sub-band Ultra-Wideband Communication Environment, (Indian Patent Publication # **05/2012**, Feb. 03, 2012), by Bynam K., Nair J. P., Sen Debarati, Naniyat A. (2012)
- Method and System of Frequency Synchronization for Sub-Band Multicarrier based Wideband Systems, (Indian Patent Publication # **48/2012**, Nov. 30, 2012), by Sen Debarati, Nair J. P., Jos S., Naniyat A. (2012)
- Scalable Sub-Band Ultra-wideband Communication System, (Indian Patent Publication # **05/2012**, February 03, 2012), by Sen Debarati, Nair J. P., Naniyat A. (2012)
- Method and System for Identifying an Emergency Signal of an Electronic Device by a Coordinator Device, (Indian Patent Publication # **29/2011**, July 22, 2011), by Bynam K., Sen Debarati, Goyal G., Won E. (2011)

#### BOOK CHAPTERS

- Abraham A. et. al. (Eds.), Intelligent Systems Design and Applications, Advances in Intelligent Systems and Computing, vol 736, **Springer International Publishing**, Book Chapter 91 by Ghosh S., Sen Debarati, Design of Millimeter-wave Microstrip Antenna Array for 5G Communications - A Comparative Study, 952-960 (2018)
- Gervasi O. et al. (Eds), Computational Science and Its Applications, Lecture Notes in Computer Science, vol 10962, **Springer International Publishing**, Book Chapter 35 by Ghosh S., Sen Debarati, Performance Analysis of Different Multiband RF Energy Harvesting Systems for Wireless Sensor Networks, 521-530 (2018)

#### TECHNICAL DOCUMENT

- European Cooperation in the field of Scientific and Technical Research : Technical Document No. **IC1004 TD(12) 05038**, Sept. 2012 by Sun W., Strom Erik G., Brannstrom F., Sen Debarati, Bristol, UK (2012)

#### JOURNAL PAPERS (Last 5 Years)

- Design and Deployment of UAV-Aided Post-Disaster Emergency Network by Panda K. G., Das S., Sen Debarati, Arif W. **IEEE Access** (Accepted July 2019) (2019)
- An Iterative Semi-Blind Channel Estimation scheme and Uplink Spectral Efficiency of Pilot Contaminated One-bit Massive MIMO Systems by Boddupelly S., Mawatwal K., Sen Debarati, Chakrabarti S. **IEEE Transactions on Vehicular Technology** (Accepted June 2019) (2019)
- Risk-Aware Last-Minute Data Backup in Inter-Datacenter Networks by Das S., Panda K. G., Sen Debarati, Arif W. **IET Networks** (Published online 17 June 2019) (2019)
- A Survey of National Disaster Communication Systems and Spectrum Allocation - an Indian Perspective by Das S., Panda K., Sen Debarati, Arif W. **IETE Technical Review** 1-26 (2019)

- An Inclusive Survey on Array Antenna Design for Millimeter-Wave Communications by Ghosh S., [Sen Debarati](#) **IEEE Access** 7 83137-83161 (2019)
- Analysis of Handoff Delay for Proactive Spectrum Handoff Scheme with PRP M/G/1/K Queuing System in Cognitive Radio Networks by Hoque S., Shekhar S., [Sen Debarati](#), Arif W. **IET Communications** 13(6) 706-711 (2019)
- Iterative SAGE based Joint MCFOs and Channel Estimation for Full Duplex Two-Way Multi-relay Systems in Highly Mobile Environment by Chakraborty S., [Sen Debarati](#) **IEEE Transactions on Wireless Communications** 17(11) 7379-7394 (2018)
- Energy Efficient Scheduling for Concurrent Transmission in Millimeter Wave WPANs by Rakesh R. T., Das G., [Sen Debarati](#) **IEEE Transactions on Mobile Computing** 17(12) 2789-2803 (2018)
- On Bounds of Spectral Efficiency of Optimally Beamformed NLOS Millimeter Wave Links by Rakesh R. T., [Sen Debarati](#), Das G. **IEEE Transactions on Vehicular Technology** 67(4) 3646-3651 (2018)
- Impact of Residual Time Distributions of Spectrum Holes on Spectrum Handoff performance with Finite Switching Delay in Cognitive Radio Networks by Hoque S., [Sen Debarati](#), Arif W. **Elsevier AEÜ - International Journal of Electronics and Communications** 92 21-29 (2018)
- Analysis of Spectrum Handoff under General Residual Time Distributions of Spectrum Holes in Cognitive Radio Networks by Hoque S., Arif W., [Sen Debarati](#), Baishya S. **Journal of Information Science and Engineering (JISE)** 34(4) 851-867 (2018)
- Robust and Efficient Beam Training Scheme for Millimeter Wave Indoor Communications by Kutty S., [Sen Debarati](#) **IET Communications** 12(2) 157-168 (2018)
- A Semi-Blind Channel Estimation Algorithm for Massive MIMO Systems by Mawatwal K., [Sen Debarati](#), Roy R. **IEEE Wireless Communications Letters** 6(1) 70-73 (2017)
- Joint Estimation of MCFOs and Channel Gains for Two-way Multi-relay Systems with High Mobility by Chakraborty S., [Sen Debarati](#) **IEEE Wireless Communications Letters** 6(5) 610-613 (2017)
- Joint Frequency Offset and Channel Estimation in Distributed MIMO-OFDM Systems by Chakraborty S., [Sen Debarati](#) **Springer Wireless Personal Communications** 92(4) 1829-1847 (2017)
- Scalable Subband Subsampled Radio Architecture for Millimeter Wave Communications with Performance Analysis by Rakesh R. T., Kutty S., [Sen Debarati](#), Das G. **IET Communications** 10(16) 2071-2083 (2016)
- Beamforming for Millimeter Wave Communications: An Inclusive Survey by Kutty S., [Sen Debarati](#) **IEEE Communications Surveys and Tutorials** 18(2) 949-973 (2016)
- ECM and SAGE based Joint Estimation of Timing and Frequency offset for DMIMO-OFDM System by Chakraborty S., [Sen Debarati](#) **Elsevier Physical Communication** 19 47-60 (2016)
- Joint Estimation of Time, Frequency Offsets and Channel Gains with ICIs in EF multi-relay DMIMO-OFDM system by Chakraborty S., [Sen Debarati](#) **IEEE Transactions on Vehicular Technology** 66(7) 5822-5838 (2016)
- MCRB for Timing, Phase and Frequency Estimation in Presence of Self-Phase Modulation for Low Rate Optical Communication by [Sen Debarati](#) **Springer Photonic Network Communications** 32(3) 393-406 (2016)
- A Comprehensive Analysis of Spectrum Handoff Under Different Distribution Models for Cognitive Radio Networks by Arif W., Hoque S., [Sen Debarati](#), Baishya S. **Springer Wireless Personal Communications** 85(4) 2519-2548 (2015)



- Energy Efficient Scalable Sub-band based Ultra-Wideband System by Nair J. P., [Sen Debarati](#), Jos S. **Springer Wireless Personal Communication** 73(3) 1143-1167 (2013)
- MCRB for Timing and Phase Offset for Low-Rate Optical Communication with Self-Phase Modulation by [Sen Debarati](#), Wymeersch H., Irukulapati N. V., Agrell E., Johannisson P., Karlsson M., Andrekson P. A. **IEEE Communications Letters** 17(5) 1004-1007 (2013)
- Method of Generating Multiple Sets of Orthogonal Codes with Wide Choice of Spreading Factors by Jos S., Nair J. P., [Sen Debarati](#), Naniyat A. **IEEE Wireless Communications Letters** 1(5) 492-495 (2012)

#### CONFERENCE PAPERS (Last 5 Years)

- Minimizing Last-Minute Inter-Datacenter Backup with Risk-Awareness by Das S., Panda K. G., [Sen Debarati](#), Arif W. **IEEE GLOBECOM 19**, Dec. 9–13, Waikoloa, Hawaii, USA, 1-6 (2019)
- Performance Evaluation of MIMO Modulation Schemes for Indoor VLC Channels with Angular Detectors by Kumar M. L. N., [Sen Debarati](#), Mohapatra P. **IEEE VTC 19-fall**, Sept. 22-25, Honolulu, Hawaii, USA, 1-6 (2019)
- A Classification Framework for Correlated Sample Space in Cognitive Radar by Rahaman M., [Sen Debarati](#) **IEEE VTC 19-spring**, April 28-May 01, Kuala Lumpur, Malaysia, 1-6 (2019)
- An Experimental Study of C-RAN Fronthaul Workload Characteristics: Protocol Choice and Impact on Network Performance by Vinnakota V. B., Manne N., Mondal A., [Sen Debarati](#), Chakraborty S. **IEEE VTC 19-spring**, April 28-May 01, Kuala Lumpur, Malaysia, 1-6 (2019)
- A Semi-blind based Channel Estimator for Pilot Contaminated One-bit Massive MIMO Systems by Boddupelly S., Mawatwal K., [Sen Debarati](#), Chakrabarti S. **IEEE VTC 18-fall**, August 27-30, Chicago, USA, 1-6 (2018)
- SB-SAGE based Joint MCFOs and Channel Estimation for DMIMO-OFDM Systems by Chakraborty S., Kujur N. K., [Sen Debarati](#) **IEEE VTC 18-fall**, August 27-30, Chicago, USA, 1-6 (2018)
- A Semi Blind Joint CFO Estimation, Equalization and Data Detection in Presence of Non-linearity for mm-Wave Communications by Priya P., Verma S., Chakraborty S., [Sen Debarati](#) **IEEE VTC 18-fall**, August 27-30, Chicago, USA, 1-6 (2018)
- A Semi-Blind Channel Estimation Algorithm for One-bit Massive MIMO Systems by Boddupelly S., [Sen Debarati](#), Chakrabarti S. **IEEE 5G World Forum 18**, July 09-11, Santa Clara, CA, USA, 71-76 (2018)
- An Analytical Model for Millimeter Wave Outdoor Directional Non-Line-of-Sight Channels by Rakesh R. T., Das G., [Sen Debarati](#) **IEEE ICC 17**, May 21-25, Paris, France, 1-6 (2017)
- Downlink SINR Coverage and Rate Analysis with Dual Slope Pathloss Model in mmWave Networks by Korrai P. K., [Sen Debarati](#) **IEEE WCNC 17**, March 19-22, San Francisco, CA, USA, 1-6 (2017)
- EM based Joint Estimation of Frequency Offsets and Channel Gains for TWR-OFDM Systems by Chakraborty S., [Sen Debarati](#) **IEEE GLOBECOM 17**, December 04-08, Singapore, 1-6 (2017)
- Power Efficient OFDM-mmWave Communications with Low Resolution and Subsampling ADC by Rakesh R. T., Ranjan R., Gangwar S., [Sen Debarati](#), Das G. **IEEE VTC 17-spring**, June 04-07, Sydney, Australia, 1-6 (2017)
- Performance Analysis of OFDM mmWave Communications with Compressive Sensing Based Channel Estimation and Impulse Noise Suppression by Korrai P. K., [Sen Debarati](#) **IEEE ANTS 16**, November 06-09, Bangalore, India, 1-6 (2016)
- An Iterative SAGE based Semi-Blind Channel Estimation for Massive MIMO by Mawatwal K., [Sen Debarati](#), Roy R. **IEEE GLOBECOM 16**, December 04-08, Washington DC, USA, 1-6 (2016)

- Joint Estimation of Frequency Offset and Channel for EF multi-relay DMIMO-OFDM System *by* Chakraborty S., Sen Debarati **IEEE VTC 16-spring**, May 15-18, Nanjing, China, 1-6 (2016)
- Joint Time and Frequency Offset Estimation for DMIMO-OFDM in Vehicular Networks *by* Mawatwal K., Sen Debarati, Roy R. **IEEE ANTS 16**, November 06-09, Bangalore, India, 1-6 (2016)
- Joint Time-Frequency Estimation DMIMO-OFDM in presence of ICI *by* Chakraborty S., Sen Debarati **IEEE WCNC 16**, April 03-06, Doha, Qatar, 1-6 (2016)
- An Improved Numerical Optimization Method for Efficient Beam Search in 60 GHz Indoor Millimeter Wave Wireless Networks *by* Kutty S., Sen Debarati **IEEE ANTS 15**, December 15-18, Kolkata, India, 1-6 (2015)
- Joint Time and Frequency Offset Estimation for DMIMO-OFDM in Vehicular Networks *by* Chakraborty S., Sen Debarati **IEEE ANTS 15**, December 15-18, Kolkata, India, 1-6 (2015)
- MCRB for Synchronization Parameters Offset in the Presence of Self-Phase Modulation in Coherent Optical Communication *by* Sen Debarati **IEEE ANTS 15**, December 15-18, Kolkata, India, 1-6 (2015)
- Scalable Sub-band Sub-sampled Radio Architecture for Millimeter Wave Communications *by* Rakesh R. T., Chowdhary A., Sen Debarati, Das G. **IEEE PIMRC 15**, August 30-September 02, Hong Kong, China, 309-314 (2015)
- Long-Term Clock Synchronization in Wireless Sensor Networks with Arbitrary Delay Distributions *by* Sun W., Strom E. G., Brannstrom F., Sen Debarati **IEEE GLOBECOM 12**, December 03-07, California, USA, 359-364 (2012)
- Sub-sampled OFDM based Sub-band Ultra-Wideband System *by* Nair J. P., Sen Debarati, Jos S., Naniyat A. **IEEE WCNC 12**, April 01-04, Paris, France, 48-53 (2012)

#### COLLABORATIONS (PAST AND PRESENT)

- Prof. Emanuele Viterbo,  
Professor, Dept. of ECSE, & Associate Dean, Research Training of the Faculty of Engg., Monash University, Australia
- Prof. Thia Kirubarajan,  
Professor & Canada Industrial Research Chair, Electrical and Computer Engg. Dept., McMaster University, Canada
- Prof. Gerhard Kramer,  
Professor & Head, Institute for Communications Engineering, Technical University of Munich, Germany
- Prof. Henk Wymeersch,  
Professor, Dept. of Electrical Engineering, Chalmers University of Technology, Gothenburg, Sweden
- Prof. Erik Agrell,  
Professor, Dept. of Electrical Engineering, Chalmers University of Technology, Gothenburg, Sweden
- Dr. Karthik Ramasubramanian,  
Distinguished Member of Technical Staff, Texas Instruments, Bangalore, India
- Dr. Dhananjay Gore,  
Head of Qualcomm Research India, Bangalore, India
- Mr. Arijit Majumdar,  
Officer-in -Charge, SAMEER Kolkata Centre, Ministry of Elect. & Info. Tech., Govt. of India
- Mr. Caesar Cai,  
Head, Research and Development, Rosenberger Technology (KunShan) Co. Ltd., China

- Mr. Kaushal Jadia,  
Head of Product at Engg. Centre, Airbus Defence and Space, Bangalore, India
- Prof. Siddhartha Mukhopadhyay,  
Professor, Dept. of EE, Indian Institute of Technology Kharagpur, India
- Prof. Sandip Chakraborty,  
Asst. Professor, Dept. of CSE, Indian Institute of Technology Kharagpur, India

## RECENT SPONSORED RESEARCH AND INDUSTRIAL CONSULTANCY

- Title : Design and Development of Wide-Band Millimeter-wave Phased Array Antenna with Beam Forming Module  
Role : PI  
Investigator : [Sen Debarati](#)  
Sponsor : IMPRINT-2 programme, SERB, Govt. of India  
Period : 27-03-2019 to 26-03-2022
- Title : DRoNA: Development and Implementation of a Distributed Radio Network Architecture for IoT Communication  
Role : PI  
Investigators : [Sen Debarati](#), Chakraborty S.  
Sponsor : ICPS programme, DST, Govt. of India  
Period : 01-03-2019 to 28-02-2022
- Title : Blind Joint Equalization & Detection in presence of Non-linearity & Synchronization Errors for mmWave Comm  
Role : PI  
Investigators : [Sen Debarati](#), Priya P., Chakraborty S.  
Sponsor : Qualcomm India Pvt. Ltd., Bengaluru-560066, India  
Period : 01-12-2017 to 30-11-2020
- Title : Radar Target Modeling and Parameter Estimation  
Role : PI  
Investigators : [Sen Debarati](#), De A., Ray P.  
Sponsor : AIRBUS Defence & Space, Airbus Group Innovations, Head of International Operations, France  
Period : 03-06-2015 to 31-12-2019
- Title : Development of National Disaster Spectrum & Comm. Backbone Architecture with Prototype Development  
Role : PI  
Investigators : [Sen Debarati](#), Arif W., Baishya S.  
Sponsor : Ministry of Comm. & Info. Tech., Govt. of India, New Delhi-110 003, India  
Period : 30-09-2015 to 30-09-2019
- Title : Sub-sampled radio design for energy efficient 60GHz communications  
Role : PI  
Investigator : [Sen Debarati](#)  
Sponsor : ISIRD, SRIC, IIT-Kharagpur  
Period : 19-09-2014 to 31-12-2017
- Title : Opened and intelligent plug-in hybrid electric vehicle (PHVE) technologies for smart Indian cities  
Role : Co-PI  
Investigators : Mukhopadhyay S., Deb A. K., Patra A., Routray A., Maitra B., Chakrabarti P. P., [Sen Debarati](#) et. al.

Sponsor : Ministry of HI & PE, GOI, New Delhi, India; Tata Motors Ltd., Engg. Research Centre, Pune-411018  
Period : 13-10-2016 to 12-10-2019

- Title : Development of a Laboratory on Novel Electronics Control and Software for Transport by EV  
Role : Co-PI  
Investigators : Mukhopadhyay S., Sengupta S., Dey S., Sen Debarati, Chakraborty S., Mukherjee A. et. al.  
Sponsor : One Time Grant, SRIC, IIT-Kharagpur  
Period : 08-06-2018 to 27-06-2019
- Title : Facility for Design, Development and Testing of Next Generation Telecom Gears  
Role : Co-PI  
Investigators : Das S. S., Sen Debarati, Das G., Ray P., Chakrabarti S.  
Sponsor : SGDRI, SRIC, IIT-Kharagpur  
Period : 20-11-2014 to 19-11-2017
- Title : Development of CDMA Algorithm for Target Update Link  
Role : Co-PI  
Investigators : Chakrabarti S., Sen Debarati, Das S. S.  
Sponsor : BHARAT Electronics Ltd., Central Research Laboratory, Bangalore - 560 013 (A Govt. of India Enterprise)  
Period : 15-09-2014 to 07-05-2015
- Title : Performance Improvement of SDR in Frequency Hopping Dynamic TDMA  
Role : Co-PI  
Consultants : Chakrabarti S., Das S. S., Sen Debarati  
Client : Hindustan Aeronautics Ltd., SLRDC Division, Hyderabad (Govt, of India Enterprise, Ministry of Defence)  
Period : 30-06-2017 to 30-09-2017
- Title : Setting up of Centre for Safety Critical Software at IRISSET  
Role : Co-PI  
Consultants : Mukhopadhyay S., Dasgupta P., Mal R., Chakrabarti P. P., Sen Debarati (External Member) et. al.  
Client : Ministry of Railways, Indian Railways Inst. of Signal Engg. & Telecomm. (IRISSET), Secunderabad  
Period : 06-04-2015 to 13-06-2016

## **EARLIER INDUSTRIAL PROJECTS AND ACADEMIC RESEARCH**

- At Samsung Research, Frontier Research Group, Bangalore, India
  - (a) Real Application Simulator for Next Generation Smart Home
  - (b) Research and Analysis on Effect of RF Radiation on Human Body Through Simulation Model
- At Chalmers University of Technology, Dept. of Signals and Systems, Gothenburg, Sweden
  - (a) Research in Coherent Optical Communication for the FORCE (Fiber Optic Comm. Research Centre) project
- At Samsung India Software Operations, Network & OS Part, Bangalore , India
  - (a) Low power, high data rate sub-band technology for UWB Communication
  - (b) Ultra low power, low data rate Chip for connected Health Care Services
  - (c) PHY Layer Specification for IEEE 802.15 TG6 Body Area Network
- At Central Glass and Ceramic Research Institute (CGCRI), OCF Lab., Kolkata, India
  - (a) Gain & Noise Measuring Techniques of EDFA related to WDM applications & measuring some critical parameters

## PRESENTATION DETAILS

### IN ACADEMIA / INDUSTRY

- Title : 5G Communications  
Venue : IIT-Kharagpur, India; (IEEE WIE Women's Day Lecture) Mar 08, 2019
- Title : Communication Technology for Intelligent Transportation  
Venue : IIT-Kharagpur, India; (Indo-German Workshop on Intelligent Mobility) Oct 29-30, 2018
- Title : Short Range Wireless Communication Techniques and Challenges  
Venue : RVCE, Bengaluru, India; (FDP on Emerging Technolo. in Short-Range Wireless Comm.) Jul 02-06, 2018
- Title : Beamforming in mmWave Radio Transmission  
Venue : PEC, Puducherry, India; (STC on 5G mmWave Radio Trans. for High Speed Wire. Tech.) Nov 13-17, 2017
- Title : Uncertainties in Wireless Comm.: mmWave Communications and CM Techniques  
Venue : NIT, Silchar, India; (Invited Lecture to commemorate Shannon's Birth Centenary) Feb 23-25, 2017
- Title : Spectrum Needs for Advanced Communications  
Venue : IIT-Kharagpur, India; (STC on Electromagnetic Environmental Effects Management) Feb 13-25, 2017
- Title : Beamforming for mmWave Communications  
Venue : NIT-Patna, India; (Short Term FDP on Towards 5G: The Key Enabling Technologies) Dec 05-14, 2016
- Title : Millimeter Wave (mmWave) Communications and Beamforming Techniques  
Venue : NIT-Rourkela, India; (STC on Recent Trends in Wireless Communication) Oct 01-02, 2016
- Title : PHY Issues, Channel Model, Network Planning, IEEE Standardization for Short Range Communications  
Venue : IIT-Kharagpur, India; (STC on Recent Advancements in Short-Range Wireless Comm.) Jul 11-15, 2016
- Title : Spectrum Needs for Advanced Communications  
Venue : IIT-Kharagpur, India; (STC on Electromagnetic Environmental Effects Management) Feb 23-Mar 03, 2016
- Title : Millimeter Wave (mmWave) Beamforming  
Venue : NIT, Silchar, India; (Seminar on Recent Trends & Research Challenges in Comm. Engg.) May 12-13, 2015
- Title : Energy Efficient System Design Guidelines  
Venue : Technical University of Munich, Germany; June 06, 2014
- Title : Application of Wireless Signal Processing in Coherent Optical Communication  
Venue : V.R.S. Engg. College, Vijayawada, India; (Workshop on Optical Wireless Networks) Feb 22-23, 2014
- Title : An Energy Efficient Scalable Medium Data Rate Wideband System Design  
Venue : Texas Instruments, Bangalore, India; Nov 06, 2013
- Title : Energy Efficient Sub-band UWB Transceiver & Performance Improve. by Interference Rejection Filtering  
Venue : IETE, Bangalore, India; (IETE Foundation Day Lecture) Nov 05, 2013
- Title : CRLB for Parameter Estimation in presence of Fiber Non-linearity (Signal & Systems activities in FORCE)  
Venue : Chalmers University of Technology, Gothenburg, Sweden; September 19, 2011
- Title : Energy Efficient Sub-band based UWB Receiver Design  
Venue : Ericsson AB, Stockholm, Sweden; Nov 25, 2011
- Title : Next Generation Optical Communication systems : Clock Recovery in Coherent Receivers  
Venue : Chalmers University of Technology, Gothenburg, Sweden; (SSF Workshop) May 09-10, 2011

- Title : Research advances in Ultra-Wideband (UWB) Communication  
Venue : KIST-Bhubaneswar, India; (Workshop on Mobile Comm. Tech. & Networking) Mar 14, 2009
- Title : Ultra-Wideband (UWB) Communication – Fundamental and Research  
Venue : IIT-Kharagpur, India; (STC on Recent Advances in RF Technique for Wireless Comm.) July 08, 2008
- Title : Synchronization in Multi-Band OFDM for UWB  
Venue : Texas Instruments, Bangalore, India; Jan 08, 2008

#### **IN CONFERENCES / WORKSHOPS**

- IEEE VTC-18 (Fall), Chicago, IL, USA, Aug. 27-30, 2018 (Travel support by Qualcomm Inc., India)
- IEEE VTC-17 (Spring), Sydney, Australia, June 04-07, 2017 (Travel support by SRIC, IIT-Kharagpur, India)
- IEEE Globecom-2016, Washington DC, USA, Dec. 04-08, 2016 (Sponsored by MeitY, Govt. of India)
- IEEE VTC-16 (Spring), Nanjing, China, May 15-18, 2016 (Sponsored by Airbus, India)
- IEEE ANTS-2015, Kolkata, India, Dec. 15-18, 2015 (Travel support by SRIC, IIT-Kharagpur, India)
- IEEE PIMRC-2015, Hong Kong, China, Aug. 30-Sept. 02, 2015 (Travel support by SRIC, IIT-Kharagpur, India)
- IEEE Globecom-2011, Houston, TX, USA, Dec. 05-09, 2011 (Sponsored by Chalmers Univ. of Tech., Sweden)
- IEEE Swe-CTW-2011, KTH Royal Inst. of Tech., Stockholm, Sweden, Oct. 19-21, 2011 (Spon. by CUT, Sweden)
- ComSys Workshop-2011, Hallsnas, Sweden, Oct. 10-11, 2011 (Sponsored by Chalmers Univ. of Tech., Sweden)
- IEEE VTC-11 (Spring), Budapest, Hungary, May 15-18, 2011 (Sponsored by Chalmers Univ. of Tech., Sweden)
- IEEE Globecom-2010, Miami, FL, USA, Dec. 06-10, 2010 (Sponsored by Samsung Research, India)
- Samsung Technical Conference-2010, Seoul, S. Korea, Nov. 10-12, 2010 (Spon. by Samsung Electronics, Korea)
- IEEE ICC-2010, Cape Town, South Africa, May 23-27, 2010 (Sponsored by Samsung Research, India)
- IEEE PIMRC-2008, Cannes, France, Sept. 15-18, 2008 ('Young Scientist' travel support by DST, Govt. of India)
- IEEE COMSWARE-2008, Bangalore, India, Jan. 6-10, 2008 (Sponsored by Conference Organizer)
- IEEE Sponsored RSPS-'08, Guntur, India, Feb. 1-2, 2008 (Sponsored by Conference Organizer)
- National Conference NCOMT, CSIO, Chandigarh, India, April 16-17, 2004 (Travel support by IEST, Howrah, India)

#### **PERSONAL VITAE**

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