

further progress of this innovative student program.



In addition, the IEEE MTT-S Space Hardware and Radio Conference (SHaRC), a subconference of the IEEE Radio and Wireless Week, was founded and is organized by TC-29 members. Having the network of a dedicated TC in the background provides excellent support for the future growth of this event on

aerospace topics. Although the COVID-19 situation is a challenge for SHaRC, as with other conferences, it will provide the “MTT-S Space Night,” a novel format for bringing together the MTT-S space community in a relaxed atmosphere of elevated scientific talks. For the 2022 International Microwave Symposium, TC-29 wants to reach a broad field of MTT-S members with a planned panel session discussing “Small Satellites in LEO—Opportunities and Challenges for Education, Science, and Industry.”



Activities beyond the MTT-S include the “LEO Satellite Systems” (Leo SatS)

IEEE future directions small project, which was started in 2021. Besides the main organizer, Witold Kinsner, who is very active in various IEEE committees and activities, both co-organizers, Anding Zhu and Markus Gardill, are from the MTT-S and active members of TC-29. The initiative wants to consolidate activities across various IEEE Societies in the growing sector of small satellites technology.

TC-29 offers two expert talks within the MTT-S Speakers’ Bureau to provide technical content for a broad audience. Jan Budroweit from the German Aerospace Center (DLR) gives an interesting perspective on “Components off-the-Shelf (COTS) for Space,” and Tumay Kanar from Renesas is available for insights into “Enabling IC Technologies for Next-Generation Satcom Internet Connectivity.”

Furthermore, TC-29 is active in moving forward with collaborations with related Societies. As such, a technical sponsorship for SHaRC 2022 could be established with the GRSS.

Report on 2020–2021 Activities From IEEE Chapters and Student Branches in India

■ Somak Bhattacharyya

During the global COVID-19 pandemic, various MTT-S Chapters in India conducted a number of activities. IEEE MTT-S Student Branch Chapter (SBC) Jadav-



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pur University and IEEE AP-MTT Joint SBC Indian Institute of Technology (IIT) Kharagpur were awarded the IEEE MTT-S Outstanding Chapter Award 2021. The activities carried out by a few Chapters from India are discussed in this article.

Editor’s Note: Despite the pandemic, the various IEEE Microwave Theory and Techniques Society (MTT-S) Chapters and student branches in India have been quite active with both in-person and remote activities. This portion of the “MTT-S Society News” column outlines some of the highlights from the various Chapters and Student Branches throughout India over the past year.

IEEE Bombay Section MTT-S Chapter Activities

Under technical activities, the first webinar was conducted by invited speaker Dr. Meenakshi Rawat, associate professor, IIT Roorkee, on “Debugging Software-Defined Radios [SDRs] and Their Applications for Advanced Communication Systems” on 31 March 2021 (Figure 1). In her lecture, Rawat mainly focused on the creation of a low-cost SDR setup using commercially available components as well as the common problems encountered and debugging of such a system. Further, she explored the practical applications of an SDR for spectrum- and energy-efficient communications.

The second webinar was conducted on 15 April 2021 by Dr. Somak Bhattacharyya, IIT Banaras Hindu University, Varanasi, India, on “Applications for Metasurfaces in a High-Frequency Regime.” Somak discussed the role of metasurfaces for the realization of several prototypes starting from a very basic design. He also described some interesting applications of metasurface structures in the terahertz (THz) domain.

RANGE provided great industrial insights into the field of remote sensing technologies.

The third webinar was presented by the MTT-S South Indian Education Society Graduate School of Technology in collaboration with the MTT-S Bombay Section on “The RANGE MTT-S Workshop on Synthetic Aperture Radar [SAR] Remote Sensing Technology” on 18 April 2021. This workshop was conducted by Shubham Sharma, a senior remote sensing scientist at GeoSpoc. It was an excellent opportunity for participants to interact with and learn from the highly experienced and knowledgeable speaker.

RANGE provided great industrial insights into the field of remote sensing technologies. The session started with an introduction to the basic terminology, types of sensors, and electromagnetic (EM) spectrum. A brief explanation about radar and its applications was given, and the range of SAR and its uses, such as for flight patterns; the EM spectrum; polarization; scattering in SAR; and many other concepts were deliberated in great depth. Participants were taught to analyze the types of objects

seen, such as, for example, ships and radio stations. Geographic Tagged Image File Format is a valuable asset in finding geolocation data. The speaker also encouraged the use of tools like Copernicus.

The first administrative meeting was conducted on 1 January 2021 in the presence of Ashok Jagatia, Bakir Quraishi, and Dr. Ashwini Kotrashetti. The second was arranged with student volunteers on 16 March 2021. The third was conducted on 8 May 2021, and the members present were Jagatia, Quraishi, Kotrashetti, and Dr. Rekha Labade.

IEEE Antennas and Propagation Society–MTT-S Joint IIT Kharagpur Student Branch

The IEEE Antennas and Propagation Society (AP-S)–MTT-S IIT Kharagpur Student Branch Chapter (SBC), under the umbrella of the Kharagpur Section, successfully conducted 14 events in 2021, including six technical webinars and eight nontechnical activities (Figure 2). The technical webinars were based on a wide range of exciting topics, such as “Organic Antenna-in-Package for Millimeter-Wave Applications” by Dr. Duxian Liu, “Lens Antennas” by Dr. Oscar



Figure 1. The flyers for the three technical activities in the Bombay Section in 2020–2021.

Quevedo Truel, “High-Frequency Over-the-Horizon Radar” by Dr. Thay-ananthan Thayaparan, “Transceivers for 6G Wireless Communications” by Dr. Payam Heydari, and “Universally Programmable Chip-Scale THz Sources, Sensors, and Systems” by Dr. Kaushik Sengupta. Also, in one of the webinars, Prof. Kamal Sarabandi shared his research journey in applied electromagnetics.

We organized two executive committee meetings, two COVID-19 relief program meetings, one student activity committee meeting, and one quarterly meeting in 2021. We conducted a remembrance event after the sad demise of Prof. Tapan K.

Sarkar in March. We also arranged a meeting to discuss Region 10 (R10) Student Activities Committee membership development and the Leadership Training Fund for 2021 in May. Recently, the article “It’s All About Connections,” written by one of our Chapter members, was published in *IEEE Microwave Magazine*. The AP-S–MTT-S IIT Kharagpur SBC was recognized with the prestigious 2021 IEEE MTT-S Outstanding Chapter Award.

The AP-S–MTT-S IIT Kharagpur SBC was recognized with the prestigious 2021 IEEE MTT-S Outstanding Chapter Award.

IEEE Bangalore Section Joint AP-S–MTT-S Chapter Activities

The IEEE Bangalore Section Joint AP-S–MTT-S Chapter conducted 15 technical activities, including seven workshops, seven webinars, one Distinguished Lecture (DL), three Chapter coordination meetings, and three administrative activities (Figure 3). The Chapter organized the “IEEE Authorship Workshop I” to benefit students and young researchers at University Visvesvaraya

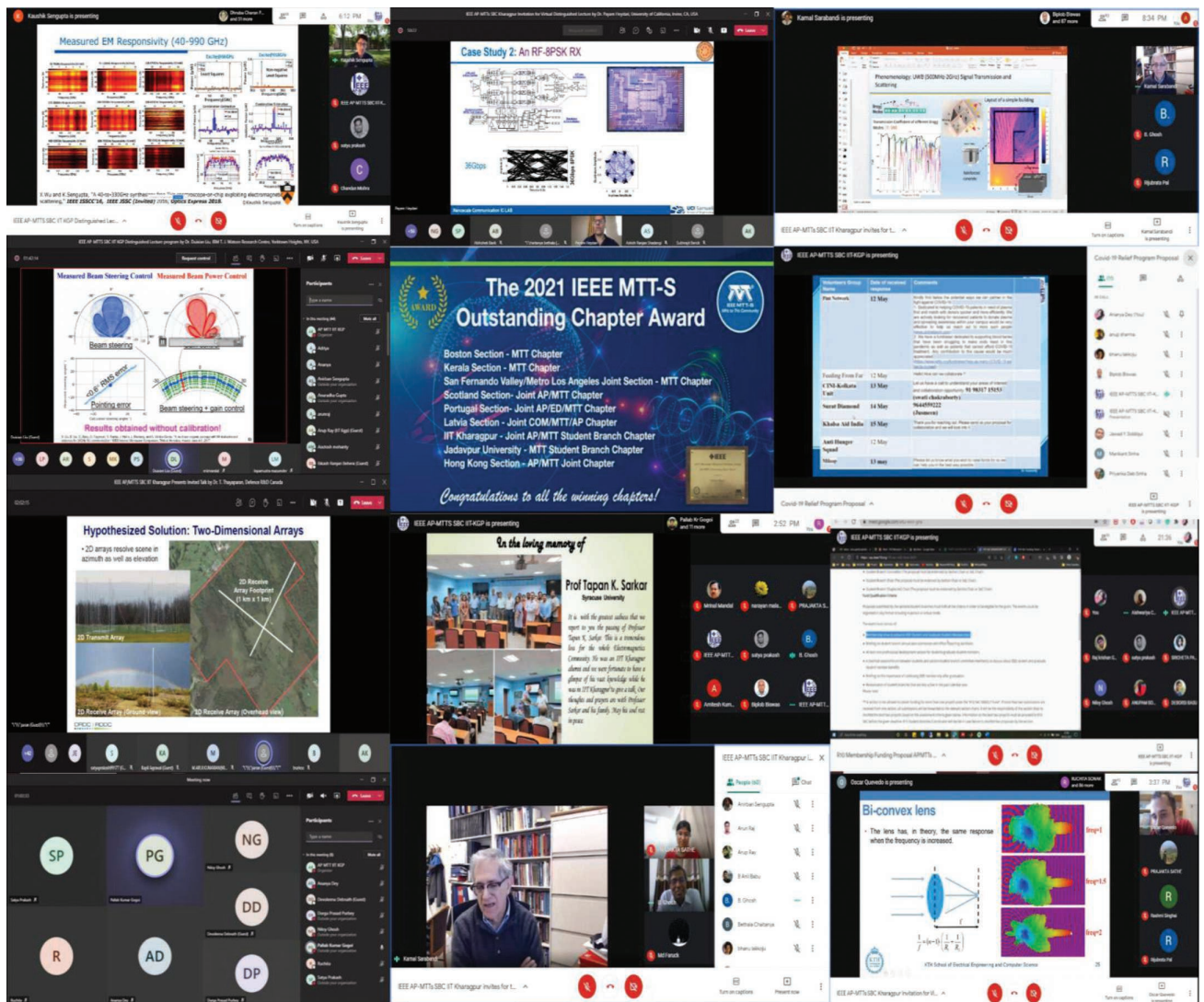


Figure 2. Some of the programs of the IIT Kharagpur Student Branch in 2020–2021.

College of Engineering, Bangalore, on 14 January 2020. Approximately 80 participants attended. The one-day workshop on “Antenna Analysis and Applications” was organized at the Rashtriya Vidyalaya College of Engineering (RVCE) on 22 February 2020. It consisted of three events and was attended by 80 participants (37 IEEE Members and 43 non-Members).

“IEEE Authorship Workshop II,” consisting of two sessions, was organized by the RVCE IEEE SBC, Joint AP-S–MTT-S Chapter of the IEEE Bangalore Section, and IEEE Bangalore Section. The first was delivered by Dr. Dhanu Pat-

tanashetti, a client services manager for IEEE. The next was delivered by Dr. Chandrakanta Kumar, a scientist with the Indian Space Research Organisation.

The Chapter organized a webinar “Signal Processing With Surface Acoustic Wave Devices” on 12 May 2020, held online; around 95 participants attended. A three-day webinar series “Practical RF/Microwave Active Circuit Design and Analysis” (online) was presented on 15–17 June 2020 in association with the AP-S–MTT-S Chapter, Bangalore Section; AP-S SBC; RVCE; and Cadence Design Systems. The speaker was Manjunath Reddy, principal

application engineer with Cadence Design Systems. The workshop was attended by 80 participants (13 IEEE Members and 67 non-Members), including undergraduate, graduate, and Ph.D. students as well as faculty members.

The Chapter organized an online webinar on “EM Aspects of 5G Massive Multiple-Input/Multiple-Output [MIMO] Systems” on 16 June 2020. The speaker was an Executive Committee (ExeCom) member of the AP-S–MTT-S Chapter. Around 138 participants attended. The Department of Electronics and Communication Engineering, RVCE, Bangalore, in association with Rohde & Schwarz and the AP-S–MTT-S Chapter, Bangalore Section, organized a webinar series on “RF Basics, Antennas, and Measurements” on 24–26 June 2020. This event was organized by the AP-S RVCE SBC. It was attended by 120 participants

The technical webinars were aimed to make participants and members technically sound with the emerging technologies in the field of communications.



Figure 3. The 2020–2021 activities of the Joint AP-S–MTT-S Chapter, Bangalore Section.

(22 IEEE Members and 98 non-Members) on day 1, 83 (13 IEEE Members and 70 non-Members) on day 2, and 66 (12 IEEE Members and 54 non-Members) on day 3.

The AP-S-MTT-S Chapter organized a conference, the IEEE International Conference on Electronics, Computing, and Communication Technologies 2020, by having a track "Antenna Systems for Futuristic Applications." The event was held online 2–4 July 2020. The Chapter organized a workshop during the conference "EM Diffraction Modeling and Simulation." A total of 26 papers were received in the AP-S-MTT-S track, and 19 were accepted after a review.

The Chapter organized an online webinar on "Phased Array Antennas: A Systems Engineering Perspective" on 31 July 2020. The speaker was an ExeCom member of the AP-S-MTT-S Chapter, and approximately 65 participants attended. A six-day webinar series on "Computational Electromagnetics and Applications" was conducted on 24–29 August 2020. The sessions were attended by 38 participants (11 IEEE Members and 27 non-Members), including undergraduate, graduate, and Ph.D. students as well as faculty from various organizations. The Chapter also organized the "IEEE Authorship Workshop III," presented by Dr. Chandrakanta Kumar and Dr. Navin Kumar on 29 August 2020 in online mode to benefit students and young researchers at Christ University, Bangalore. Approximately, 60 people participated in the workshop.

The IEEE Bangalore Section and AP-S-MTT-S Bangalore Section conducted an online webinar on "Opportunities in Electromagnetics and Microwave Engineering" on 17 September 2020 from 10 a.m. to 11:30 a.m. The speaker was Dr. Cynthia Furse, associate vice president for research and professor of electrical and computer engineering at the University of Utah. Approximately 75 participants attended the webinar (20 IEEE Members and 55 non-Members). The participants were undergraduate, graduate,

and Ph.D. students as well as faculty from various organizations.

The APS SBC; RV College of Engineering; AP-S-MTT-S Chapter, Bangalore Section; and IEEE Bangalore Section organized the AP-S-sponsored DL "Lens Antennas: Fundamentals and Present Applications" on 19 October 2020 from 2 p.m. to 3:30 p.m. The speaker for the webinar was Dr. Oscar Quevedo-Teruel, associate professor at the School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Sweden, who is an AP-S Distinguished Lecturer for 2019–2021. Around 73 participants attended the webinar (16 IEEE Members and 57 non-Members).

The AP-S-MTT-S Chapter, Bangalore Section, and IEEE Bangalore Section jointly organized a 6-day online workshop on 8–13 December 2020 "Microwave and Antenna Applications in 5G," focused on aspects such as antennas, circuits, systems, and measurements of microwave and antenna applications in 5G. The speakers were Prof. Satish K. Sharma, director, Antenna and Microwave Lab, San Diego State University, United States; Dr. Debdeep Sarkar, assistant professor, Electrical and Computing Engineering Department, IISc, Bangalore; Dr. C.J. Reddy, Fellow of IEEE and vice president of electromagnetics, Altair Engineering, Inc., United States; Dr. Bibhudatta Sahoo, assistant professor, IIT Kharagpur; Dr. S. Aniruddhan, assistant professor, IIT Madras; Prasad Bhat, chair and CTO, Astrome Technologies; and Nazim Ahmed, wireless application expert, Keysight.

Chapter coordination meetings were conducted (one in person and two online), where operational procedures and plans for organizing various events were discussed. Three administrative meetings (one in person and two online) were held during

2020, and the administrative activities of the Chapter were discussed.

IEEE MTT-S Motilal Nehru National Institute of Technology Allahabad SBC

The IEEE SBC of the MTT-S Motilal Nehru National Institute of Technology (MNNIT) Allahabad Section (MTT-S SBC 08071), under the guidance of

Faculty Advisor V.S. Tripathi, a professor at MNNIT Allahabad, in coordination with Chair Piyush Kumar Mishra, successfully conducted 11 events in 2020, including six technical webinars and five nontechnical activities (Figure 4). The technical webinars were aimed to make parti-

cipants and members technically sound with emerging technologies in the field of communications. Nontechnical events mainly focused on professional webinars along with an IEEE Day celebration. The following describes the various activities for the year at MNNIT Allahabad:

- "Engineering the Future in the Post-COVID Era," a technical webinar, was held on 14 September 2020 by Prof. S.K. Ramesh, director of the All India Institute of Medical Sciences program and professor of electrical and computer engineering, California State University, Northridge, United States.
- The technical webinar "Wireless Technology Innovation: Opportunities for You" was presented on 20 September 2020 by Ravi Prakash, national head of operations and maintenance as well as networks, Bharti Airtel Network.
- "The Future of Budding Engineers in Civil Services and Engineering Services," a professional webinar, was conducted on 27 September 2020 by Mayank Mittal, AIR-29 Civil Services 2019, AIR-1 Indian Engineering Services.

In his talk, Song provided insight into design challenges in the THz range and solutions to them at such a high frequency.

- A professional webinar, “Higher Studies in the United States and Their Planning,” was held on 4 October 2020 by Deeksha Gupta, senior data scientist at CVS Health, United States, who holds an M.S. degree in business analytics from the University of Illinois at Chicago.
- “Leveraging Technology for a Better Tomorrow” was the theme

for the IEEE Day celebration on 6 October 2020, conducted through a PowerPoint presentation by the MNNIT Allahabad SBC.

- The “Holistic Growth Through Studying Abroad” professional webinar was presented on 11 October 2020 by Paramdeep Singh, who holds an M.S. degree from Texas A&M University, Texas, and was a software

engineering intern at Facebook (2020) and a software engineer at Visa (2017).

- “Startup Ecosystem,” a professional webinar, was held on 18 October 2020 by R. Sasikant, a board member, business mentor, business consultant, senior subject matter expert, business partner, business owner, adjunct faculty, and coach at Aye2Zee Venture

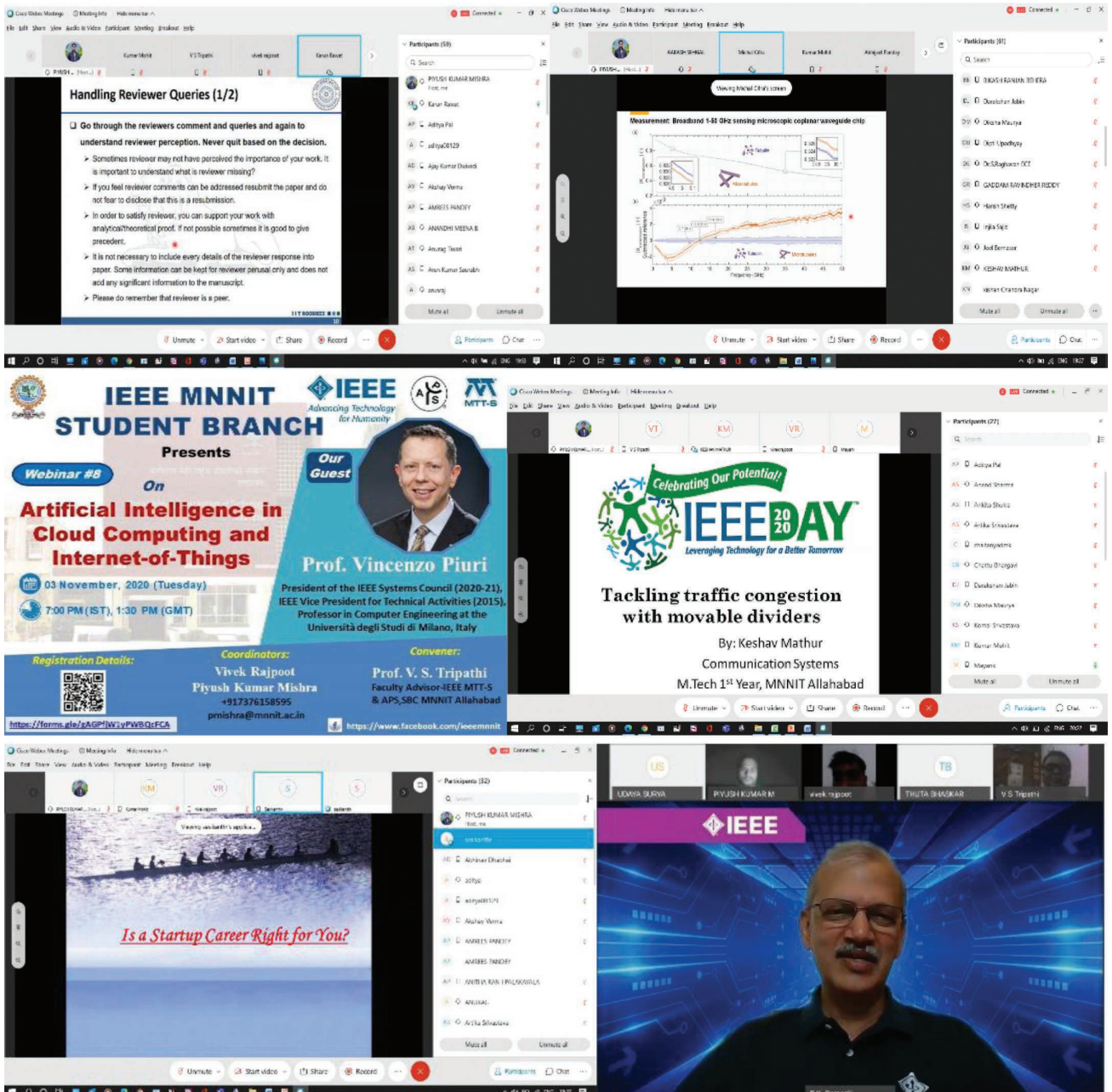


Figure 4. Screenshots from the programs of the Allahabad Student Branch in 2020–2021.

Consultancy as well as a former vice president of Hindustan Computers Limited Infosystems.

- The technical webinar “Secrets of Writing a Good Research Paper” was given on 25 October 2020 by Karun Rawat, associate professor at IIT Roorkee, Senior Member of IEEE, member of the MTT-S Microwave High-Power Techniques Committee, and chair of Linear Amplifier Technologies and Services Pvt. Ltd.
- “Artificial Intelligence in Cloud Computing and the Internet of Things,” a technical webinar, was hosted on 3 November 2020 by Prof. Vincenzo Piuri, a professor of computer engineering at the Università degli Studi di Milano, Italy; former president of the IEEE Systems Council (2020–2021); IEEE vice president for technical activities (2015); and director and president of the IEEE Computational Intelligence Society.
- The technical webinar “Engineering EM Devices Based on Biophysical Insights for Future Biomedicine” was presented on 16 November 2020 by Dr. Michal Cifra, IEEE Senior Member and chair of the IEEE Engineering in Medicine and Biology Czechoslovakia Section as well as head of the bioelectrodynamics research team and senior scientist at the Institute of Photonics and Electronics of the Czech Academy of Sciences, Czech Technical University in Prague, Czechia.

- “Innovative Millimeter-Wave High-Gain Antennas for Enhanced Wireless and Satellite Communication Applications” was a technical webinar held on 28 November 2020 by Prof. Satish K. Sharma, director of the AML, Department of Electrical and Computer Engineering, San Diego State University, California, United States.

These webinars and activities were an excellent opportunity for everyone who participated to get a chance to interact with and learn from the highly experienced and knowledgeable speakers in virtual mode and clarify their doubts.

IEEE MTT-S Amrutvahini College of Engineering SBC

The MTT-S Amrutvahini College of Engineering (AVCOE) SBC conducted several technical activities during the 2020–2021 time period (Figure 5). The first program was a Distinguished Microwave Lecturer talk on “THz Communications at 300 GHz: Devices, Packages, and Systems” by Prof. Ho-Jin Song, Department of Electrical Engineering, Pohang University of Science and Technology, Korea, on 9 August 2020. In his talk, Song provided insight into design challenges in

the THz range and solutions to them at such a high frequency.

The first webinar, on “4G, 5G, and

Beyond,” was organized on 22 May 2020 and delivered by Dr. Saurabh N. Mehta, chief academic officer and professor at Vidyalkar Institute of Technology, Mumbai, India. The session helped all participants understand the developments and requirements of next-generation communication systems. The second webinar, “Development in THz Technology for Radio Astronomy, Atmospheric Sensing, and

Imaging,” was conducted by Dr. Colin Viegas, researcher/engineer at Teratech Components, Oxford, United Kingdom, on 18 September 2020. A third webinar, “IEEE Resources and Initiatives on Emerging Technologies,” was presented by Dr. Lance C.C. Fung, professor emeritus, Murdoch University, Perth, Australia, on 27 July 2020.

MTT-S Jadavpur University SBC: Spreading Tender Roots Across R10 and Beyond

The MTT-S Jadavpur University SBC was founded in 2019. In the first year since its inception, it hosted nine technical and administrative events where renowned researchers, such as Prof. Shiban K. Koul (IIT Delhi), Prof. Ajoy Chakraborty (IIT Kharagpur),

The MTT-S Jadavpur University SBC turned the past pandemic year of 2020 into a great learning opportunity for technologists, researchers, scientists, and students alike.

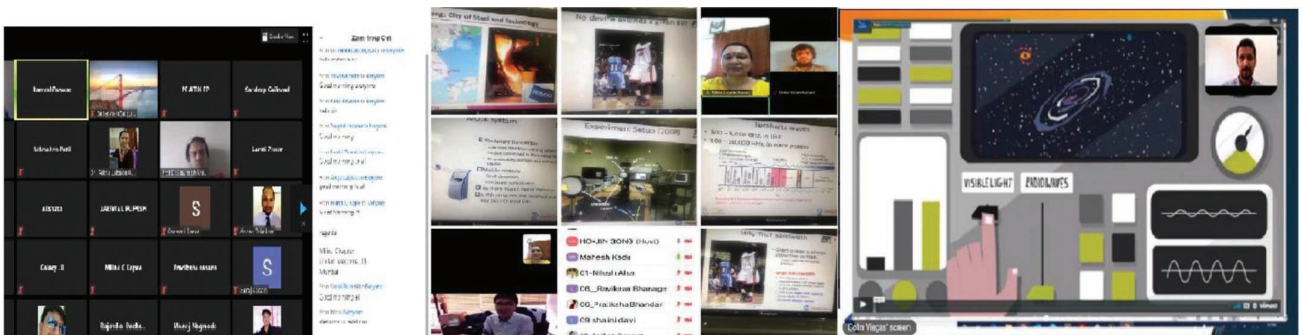


Figure 5. The events hosted by the AVCOE Student Branch in 2020–2021.

Prof. A.K. Mallick (IIT Kharagpur), Dr. Nemaï Chandra Karmakar (Monash University, Australia), and many others delivered technical lectures. An innovative annual contest, the “Doctoral Scholars’ Colloquium,” was developed and successfully hosted for the first time in the same year.

In 2020, this Chapter hosted 28 activities (mostly in virtual mode), including 18 technical talks, one workshop, an event to collect 1,000 technical books, four contests, one outreach activity for school students, and three administrative meetings (Figure 6). Technical events, such as “Online Quiz on Electromagnetics, Microwaves, and Antennas,” “Advances in Tracking Radar Systems for Test Range Applications,” “Challenges in Spacecraft Antenna Design,” and “Online Picture Puzzles on Electromagnetics, Microwaves, and Antennas,” were able to create special interest among participants across India and IEEE R10.

Events were hosted for microwave graduates and scholars to provide a good bonding opportunity and a joyful start to the year.

The “Second Doctoral Scholars’ Colloquium (2020)” was hosted on 28 November 2020, with 10 doctoral candidates shortlisted from renowned institutes, including IIT, NIT, IEST, and other universities. A special talk, “Communication: Past, Present, and Future,” was organized on 6 December 2020 to motivate 74 school students to pursue a career in engineering and research fields. Finally, the MTT-S-sponsored workshop on “Different Computational EM Techniques and Their Applications” was successfully hosted on 27–29 December 2020. The MTT-S Jadavpur University SBC turned the past pandemic year of 2020 into a great learning opportunity for technologists, researchers, scientists, and students alike.

In 2021, the SBC has already hosted nine virtual technical talks, including three DLs. The first talk was delivered by Dr. Andrea Michel (University of Pisa) on 23 January 2021, “RF Identification Systems for Unusual Applications.” On 21 March 2021, the first DL, “Toward Universally Programmable Chip-Scale THz Sources, Sensors, and Systems: Bridging the THz and Application Gap in the Next Decade,” was delivered by Dr. Kaushik Sengupta (Princeton University). The second DL was delivered by Prof. Dan Jiao (Purdue University) on “Fast Solvers for the Electromagnetics-Based Analysis and Design of Integrated Circuits [ICs] and Systems,” and it was held on 10 April 2021. Prof. Cynthia Furse (University of Utah) delivered the



Figure 6. Different technical activities hosted by the MTT-S Jadavpur University SBC as well as an award and recognition received.

last of the three DLs “Bioelectronics and the Bionic Age: How Bioelectronics Touch Our Hearts and Minds” on 6 May 2021.

It has taken a lot of dedication and hard work to host these events (Figure 6). As a token of appreciation for our efforts, the IEEE Kolkata Section presented Ardhendu

Kundu (immediate past Chapter chair, 2020) with the Outstanding Student Volunteer Award 2020 during the 42nd Annual General Meeting on 16 January 2021. In addition, this young Chapter also received the 2021 IEEE MTT-S Outstanding Chapter Award for its exemplary technical contribution.

MTT-S IIT Roorkee Chapter Activities in 2020

The MTT-S IIT Roorkee Chapter conducted six technical and nontechnical activities during 2020 (Figure 7). The first technical lecture was conducted in collaboration with the Optical Society of America (now Optica) IIT Roorkee SBC, “The International Day of



Figure 7. The 2020–2021 programs of the IIT Roorkee Chapter.

Light and Integrated Optics or, Simply, Light-on-a-Chip,” by invited speaker Prof. Alina Karabchevsky, Ben-Gurion University of the Negev, Israel, on 16 May 2020.

The second technical webinar was conducted by Dr. Saptarshi Ghosh, IIT Indore, India, “Advanced Fabrication Techniques in Microwave Applications” on 23 September 2020. In this talk, some of these fabrication methods were described in light of their uses in passive/active microwave devices.

Dr. Debdeep Sarkar, IISc, Bangalore, India, conducted the third technical webinar “Massive MIMO Antennas: Design and Analysis From an EM Perspective” on 28 September 2020. This presentation uncovered various critical EM aspects of massive MIMO systems. The first part shed light on the various antenna elements and topologies for massive MIMO architectures that enable directional radiation in the downlink, low interelement mu-

tual coupling, and full-dimensional beamforming. The next section of the talk addressed some pertinent EM issues on uplink channel modeling for massive MIMO systems.

The fourth technical webinar was presented by Dr. Akhilesh Mohan, IIT Kharagpur, India, “Substrate Integrated Waveguide [SIW]-Based Planner Antennas” on 1 October 2020. This session focused on the different design aspects of planar antennas based on SIW technologies. Planar SIW antennas can broadly be classified into two categories: SIW slot and miniaturized SIW antennas. The judicious application of transverse slots on the SIW cavity leads to the radiations from the slots. Finally, this presentation discussed the design of miniaturized SIW antennas, which are compact compared to conventional SIW slot antennas.

Our fifth technical activity, the two-day Workshop on Monolithic Microwave IC Low-Noise Amplifier

(LNA) Design Using Path Wave ADS 2021, was organized for 29–30 September 2020. The first day started with an introduction and a lecture on ADS, which covered different LNA fundamentals, dc, S-parameter and stability analysis, nonlinear HB one- and two-tone analysis, and subsections in IMN and OMN networks. On the second day, the workshop covered statistical analysis (yield analysis), monolithic microwave IC LNA layout, verification—Design Rule Checker and Layout Versus Schematic, and EM analysis using ADS Radio Frequency Pro Simulator.

Besides the technical activities, one nontechnical activity was organized in the presence of Dr. Karun Rawat, IIT Roorkee, on 3 January 2020. Events were hosted for microwave graduates and scholars to provide a good bonding opportunity and a joyful start to the year, and a brief introduction about the MTT-S and its benefits was given to the newly joined scholars.

Distinguished Lecturer Series 2021 by the IEEE MTT-S National Institute of Technology Silchar, India, Student Branch Chapter

■ **Debanjali Sarkar and Taimoor Khan**

The entire world has witnessed an unprecedented global health crisis that forced the wheels of life to come to a standstill. However, with the adoption of technology and digital platforms, we have managed to remain globally connected even in

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