Flexible Antennas, 3D Printed Radio Frequency Circuits, and Real-Time In-situ Wireless Monitoring

Dr. Sayan Roy

Assistant Professor, Department of Electrical Engineering

SDSM&T

Abstract:

The massive popularity and versatility of wireless technology have created a new paradigm in communication engineering. Millions of physical devices, sensors, automobiles, biomedical, mining devices are designed nowadays to be wirelessly connected to a network system or sometimes directly to the internet (IoT). An integral part of any wireless system is the antenna which transmits and receives signals from/to the free-space. Typically, antenna geometries are made planar by default for ensuring coherent transmission and reception of signals. However, incorporation of flexible antenna systems which can work in real-time on both planar and non-planar surfaces is a must for wearable applications such as antennas on spacesuits and antennas mounted on the body of fast moving objects such as cars, trains, planes, missiles, and rockets. The first section of this seminar covers the challenges and the solutions in designing flexible antenna system for such real-time applications. The second section of this seminar presents a novel technique on realizing 3D printed radio frequency (RF) circuits. The broad usability of RF circuits is multifold, such as transmitters, receivers, filters, amplifiers, detectors, shielding, and digital radio. Sometimes, these versatile applications require RF circuits to be engineered with shapes which are complicated and economically expensive for realizing using conventional manufacturing processes. An alternative novel way to build such RF circuits with complex geometries is using the additive manufacturing (3D printing) technology that offers greater flexibility on the designing aspect at low cost. The third and last topic of this seminar is wireless remote monitoring which is gaining popularity these days among researchers and engineers in the fields such as mechanical, electrical, biomedical, civil, mining, etc. However, the monitoring scheme and wireless technology vary substantially based on the nature of such applications. A short discussion of an integrated, real-time, wireless, remote monitoring system for a non-destructive damage assessment scheme will conclude the seminar.

Bio Sketch:

Dr. Sayan Roy is an Assistant Professor in the Dept. of Electrical Engineering at South Dakota School of Mines & Technology since Jan 2019. His research interests focus on real-time applications of wireless sensors and composite antennas in such fields as healthcare, agriculture, power transfer, wearable, and UAS payload. Dr. Roy has co-authored 6 journals, 20 peer-reviewed proceedings, 1 invention disclosure, multiple research proposals, and more than 20 non-peer reviewed posters and articles.

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