Wearable Electronics Integrated with Flexible Textile Antennas

Navtej Singh Saini*, Asimina Kiourti, Robert Lee, and John L. Volakis
ElectroScience Laboratory, ECE Department, The Ohio State University

Wearable devices are of significant interest for several applications including, but not limited to, sports, medical sensing, baby/child monitoring, kinematics, and wireless sensing applications in harsh and demanding conditions. Though much research has been performed in this field, a number of questions remain unanswered. For example, existing wearable electronics and on-body sensors are restricted to a limited class of applications due to their bulky form factor and limited range of communication. Another challenge relates to the need for unobtrusive integration of wearable antennas and associated sensors with electronics to realize fully-integrated and flexible wearable prototypes.

The goal of this research is to develop flexible antennas integrated with sensors and other electronics to achieve long range communications. The aim is to enable data uploads to cloud storage sites for future post-processing for new range of wearable applications. With this in mind, the paper will present robust, lightweight, and flexible antennas that deliver consistent reliable RF performance while integrated with underlying electronics, all in an unobtrusive form factor using textile antennas. Our textile antennas are developed using an automated embroidery process that employs conductive E-threads, each consisting of 7 to 664 metal-coated polymer filaments twisted together. In doing so, the developed antennas are highly flexible, lightweight and robust. Notably, geometrical precision as high as 0.1mm can be achieved, viz. similar to that of traditional Printed Circuit Board (PCB) prototypes. These antennas can be easily integrated into clothing while delivering the desired RF performance.

At the conference we will show the operation of textile electronics in conjunction with different wireless communication standards (RFID, Bluetooth, Wi-Fi, etc.) for a multitude of sensing applications.