Wireless and Batteryless Micro/Nano-Sensors for Seamless Healthcare

Abstract: Recent advances in wireless wearable sensors, implantable devices, and electronic skin (e-skin) technologies are opening new opportunities for precision healthcare by extending continuous and personalized monitoring beyond traditional clinical settings and into homes and communities. This talk will highlight our recent advances in micro/nanotechnology-driven wireless sensors, telemetry techniques, and integrated systems, paving the way for intelligent, miniaturized, and maintenance-free biosensing technologies that enable seamless healthcare delivery. The first part of this talk will explore how "parity-time (PT)-symmetry" and "exceptional points" — concepts originally from quantum mechanics — can be translated into electronics to enhance the sensitivity and spectral resolvability of passive wireless wearable, nearable, and implantable sensors. The second part will introduce fully passive wireless sensors designed for real-time, continuous monitoring of physical and biochemical signals, even in cluttered and interference-prone environments. Particular attention will be given to wireless and batteryless biosensors incorporating chemically sensitive radio-frequency modulators and oscillators based on nanomaterial field-effect transistors. Finally, the talk will present emerging wearable antennas, interconnects, and electronic circuits fabricated from soft, flexible, stretchable, and breathable nanocomposite materials, highlighting their applications in e-skin technologies and next-generation intelligent healthcare systems.