

Pai-Yen Chen DL Talk Title and Abstract

Title: Zero-Power Wireless Micro-/Nano-Sensors for Internet-of-Things Applications

Abstract:

With the rapid advent in micromachined and nanotechnological sensors, and the ever-advancing wireless communication technologies, the idea of internet of things (IoTs) has had a revolutionary impact on ubiquitous computing with massive amount of data gathered from the 5G-connected smart objects. This new paradigm has become the driven force for many new technologies, such as smart city, smart home, industry 4.0, point of care (POC), to name a few. In this lecture, I will give an overview of recent progress on 5G/B5G-connected IoT sensors and systems, as well as security primitives and protocols for ultralow-power sensor. In the first part of this lecture, I will discuss new types of lightweight, flexible, batteryless and wireless sensors based on nanomaterial-based devices, circuits, and antennas. I will present several application examples, including (1) all-graphene transparent smart contact lenses for real-time, continuous monitoring of glucose level, intraocular pressure, and/or viral/bacterial pathogens [1], and (2) flexible, breathable, and comfortable smart face masks for monitoring coughs, mask wearing, vital signs, airborne pathogens, and/or Infectious diseases [2]. In the second part of this lecture, I will discuss how the concept of parity-time (PT)-symmetric non-Hermitian Hamiltonian, first discovered in quantum physics, can be implemented using electronic circuitries and applied to improve sensitivity and resolvability of wireless micro/nano-sensors, with in-vivo demonstrations [3-5]. I will also show new nanomaterial-based RF/analog circuits that enable encryption key generation for identification and authorization, paving a new pathway towards RFID and IoT security primitives [6,7].