

Lecture 1:

Title: Wearable Magnetic Skins and Sensors

Abstract:

Magnetic sensors are one of the most pervasive sensors in industry and consumer devices. They have a very long history starting with the compass more than 2000 years ago. Many different magnetic sensors have been developed, exploiting various physical principles, to obtain optimized performance for specific applications with respect to sensitivity, power consumption, size, field range or resolution. In the era of ubiquitous sensing, wearable devices and smart things, the unique features of magnetic sensing systems put them at the forefront of novel applications and new features.

This presentation provides insights into latest developments on flexible magnetic skins and sensors, which feature high performance, biocompatibility and conformability. Such devices are employed in biomedical instruments, marine monitoring, or machine-user interfaces, enhancing functionalities and capabilities. Flexible and wearable magnetic sensor systems can extend our senses, provide contactless control or steering and add intriguing new functionalities to our natural capabilities. Examples are flexible magnetic tunnel junction sensors, which are employed for 3-axes orientation monitoring on biomedical instruments. On the other end of the spectrum are printed graphene Hall effect sensors with less sensitivity but high temperature and corrosion resistance. Magnetic composites made of polymers with magnetic materials as fillers combine mechanical flexibility with magnetic functionality. Such materials have been integrated with magnetic sensors to form bioinspired artificial cilia sensors, resulting in low-power tactile sensors with multifunctional capabilities as artificial skins, for flow sensing or brail reading. Ultra-flexible magnetic skins can be worn like tattoos or camouflaged with the color of the skin tone and enable wireless operations, ranging from tracking of eye movements to hands-off machine control. Modern fabrication processes combined with the advantages of magnetic sensor systems are a strong combination, which can lead to a myriad of new sensor solutions and benefit smart things, robotics, medical devices and much more.