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Hosted by Prof. Yu SONG

Bioelectronics based on soft, deformable structures

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Yeung Kin Man Academic Building

Abstract

Bioelectronics can seamlessly integrate with the human body and other biological systems, both non-invasively as wearables and invasively as implants. In this talk, I will introduce a set of soft, deformable structures that can promote the sensing capabilities of bioelectronics. First, I will discuss the development of passively deformable 3D structures for tactile sensing. These structures exploit lithographically defined thin wires of metal or alloy in 3D as the sensing elements. The 3D design enables accurate, hysteresis-free and decoupled measurements of temperature, normal force and shear force, with capabilities ranging from high-density mapping of pressure, to wireless monitoring of biomechanical signals, and to decoupled measurement of tri-axial forces. The second part of the talk focuses on actively deformable magnetic structures for wireless sensing. Such magnetic structures are chip-less and battery-less, and can support wireless measurements of various biophysical and biochemical signals when paired with a wearable transceiver. Experiments in rat models demonstrate the capabilities of measuring cerebrospinal fluid viscosity, intracranial pressure, and glucose levels. This miniaturized system opens the possibility for continuous, wireless monitoring of a wide range of biophysical and biochemical conditions within the living organism.

Biography

Dr. Mengdi Han is an Assistant Professor in the Department of Biomedical Engineering, College of Future Technology, Peking University. He received his B.S. degree in Huazhong University of Science and Technology in 2012 and Ph.D. degree in Peking University in 2017. He was a visiting Ph.D. student at Department of Materials Science and Engineering, University of Illinois Urbana-Champaign from 2015 to 2017. He worked as a postdoctoral fellow at Querrey Simpson Institute for Bioelectronics, Northwestern University from 2017 to 2020. He published more than 100 SCI-indexed papers, including first/corresponding author papers in Nature Electronics, Nature Biomedical Engineering, Science Translational Medicine, Science Robotics, Science Advances, PNAS, Advanced Materials, etc. His research group aims to develop advanced micromechanical bioelectronics for electronic skins, wireless biosensors and microrobotics. His research has been recognized with many awards including Microsystems & Nanoengineering Young Scientist Award (2020), MIT Technology Review Innovators Under 35 Asia Pacific (2021), World's Top 2% Scientists by Stanford & Elsevier (2023, 2024), iCANX Young Scientist Award (2024), and Asian Young Scientist Fellowship (2024).