IEEE CAS-EDS-SSCS Wuhan Joint Chapter and Huazhong University of Science and Technology Organize a Technical Talk

The IEEE Circuits and Systems Society (CAS), IEEE Electron Devices Society (EDS), and IEEE Solid-State Circuits Society (SSCS) Wuhan Joint Chapter, along with the School of Optical and Electronic Information, Huazhong University of Science and Technology (HUST), China, held a technical talk by Professor Yong Ping Xu, National University of Singapore (NUS), on 23 July 2019. Dr. Xu presented a lecture, "Implantable Medical Devices: Interface With the Human Nervous System." This was the first time an SSCS technical event was held on the HUST campus after the formation of the CAS-EDS-SSCS Wuhan Joint Chapter was approved in early July 2019.

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Prof. Yong Ping Xu delivers his talk, "Implantable Medical Devices: Interface With the Human Nervous System," at HUST.

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Prof. Xu (standing) answers questions from HUST faculty and students.

Prof. Xu started his talk by briefly introducing the history of implantable medical devices that interface with the human nervous systems.

Prof. Xu started his talk by briefly introducing the history of implantable medical devices that interface with the human nervous systems. First, he highlighted commercialized devices that have been widely used in various medical applications, such as cochlear implants and pacemakers. He also discussed advanced mechanisms being developed for emerging applications, such as neural-recoding and stimulatory devices for treating neurological problems caused by nervous system disorders and injuries. He introduced the principles behind human nerve cells and explained the

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Prof Xu meets with organizers from HUST after the lecture. (From left): Dr. Min Run, Dr. Xiaojun Bi, Prof. Benpeng Zhu, Prof. Xu, Prof. Xuecheng Zou, Prof. Chao Wang, Dr. Zhige Zou, and Dr. Guoyi Yu.

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generation and transmission of nerve signals. Citing a few case studies of cutting-edge implantable medical devices, he explained how to used advanced microelectronic technology and IC design to record neural signals and stimulate nerve cells with high efficacy.

Prof. Xu described how a system-on-chip device is designed to be capable of altering neural activities through neuromodulation and hence can perform neurotherapy and nerve repair or act as a neuroprosthesis. He explained the design approach of some exemplary circuits, including neural-recording amplifiers and electrical simulator circuits created by his team at the NUS. These novel circuit solutions were discussed to explain how to address the stringent challenges in neural interface design, such as ultralow noise, high input impedance, large input dynamic range and low power consumption for neural-recording amplifiers, sufficient stimulation strength with high efficacy, and safety compliance for electrical simulators.

The audience listened to the talk with interest and asked many questions during interactive discussions.

Prof. Xu described how a system-on-chip device is designed to be capable of altering neural activities through neuromodulation.

Prof. Xu gave thoughtful answers and provided insight into the brain–machine interface system designs of the future. Bingqiang Liu, a year-three HUST undergraduate, said, "Prof. Xu taught us how to design appropriate stimulation circuits to enable people to regain control of their limbs and heal human nerves. From the lecture, we can see many scientific problems and technical challenges in the fields of biomedical circuits and devices. Prof. Xu's talk was meticulous and inspiring, which makes me consider the cutting-edge research field and technology direction of solid-state circuit designs."

Undergraduate student Qirun Hong said, "From the lecture, I was quite surprised to see circuit structures similar to those in the CMOS analog IC design textbooks. It can be seen that the many classical circuits we have learned about in the undergraduate classes are still practical in actual designs and still have great potential. I believe that operational amplifiers, as the basis of analog circuits, will continue playing a very important role in the design of advanced analog circuits for many emerging applications."

—Chao Wang
Chair, IEEE CAS-EDS-SSCS
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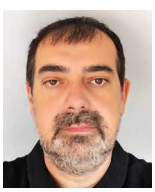

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