School of Electrical Engineering

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▣ Introduction

Electrical Engineering at KAIST is a research-oriented department with 15 research centers in semiconductors, control and systems, microwave and lightwave, computer and circuit design, communications, and signal processing. The department includes about 90 faculty members, 1,000 graduate and 500 undergraduate students, and 19 administrative staffs.

The educational objective of the department is to foster men and women with talents to become leaders in electrical engineering. To achieve our objective, the bachelor of science program emphasizes the fundamentals of modern electrical engineering from devices to systems; the masters of science program emphasizes professional skills that the industry demands, and the doctor of philosophy program encourages creative research that will be beneficial to human kind.

The operational objective is to produce future leaders with vision, creativity and communication skills through research and education which will have a dramatic effect on our future world.

The curriculum characterized by diverse cooperation with industrial agencies, understanding of theory and concepts by in-depth study as well as experimental verifications, and variety of group seminars is organized so that the students can fully enhance their technical knowledge and develop their ability so to put their knowledge into practice.

Electrical Engineering of KAIST pledges to make constant and sincere efforts to cultivate visionary leaders.

▣ Research Groups

➢ Circuits and Systems Group

The Circuit and systems group focus on enhancing human life quality by the realization of state-of-the-art wired/wireless telecommunication system, bio/healthcare-related system, as well as energy-efficient green environment management system. With such vision in mind, we are striving to contribute in the research areas of digital/analog circuit designs, mixed circuit designs, platform designs, design automation/verification, wired/wireless telecommunication, healthcare, and green-energy systems.

➢ Nano Devices and Integrated Systems Group

Nano Devices and Integrated Systems (NDIS) group focus on improving quality of human life by the realization of state-of-the-art nano device and system technology based on the semiconductor devices and fabrication such as CMOS device, MEMS device, organic device, display technology, energy harvesting device, optoelectronic device, high frequency device, quantum computing and neuromorphic device for artificial intelligence, soft electronics, bio/medical/health-care related device and system. NDIS group covers a broad range of fundamental science to applied science and engineering for commercialization by employment of a novel device, a novel structure, a novel concept, new materials, and a novel fabrication technology.

➢ Electromagnetics and Photonics Group

Microwave and photonics group research activities cover the two major areas; the first research area (Applied Electromagnetics) focuses on the electromagnetics scattering, diffraction, wave propagation, including RF/microwave and millimeter-wave circuits, antennas, packaging, system and the other research area (Optics and Photonics) conducts research in photonics, quantum optoelectronics, optical communication, nanoscale optical device, nanophotonics, plasmonics, silicon photonics, optical sources, optical MEMS, and biophotonics. Application areas of our group include the physics, devices, and systems using

electromagnetics and photonics for various applications including communications, display, energy, environments, imaging, health care, sensing, and security.

- Applied Electromagnetics: Electromagnetics scattering, diffraction, and radiation problems, analytical and numerical techniques of electromagnetics, analysis and design of antenna, precision antenna measurement techniques, beam forming antenna, RFID systems, radar systems, remote sensing, meta-materials, signal and power integrity in 3D ICs, Radio Frequency (RF)/microwave/ millimeter/sub-millimeter-wave's circuits and systems
- Optics and Photonics: Optical Interconnection, optical switching, photonic signal processing devices, optofluidic device for 3D display, semiconductor light sources, terahertz generation and applications, nanoscale optics, integrated photonics and optoelectronics, optical MEMS, quantum communications, micro/nano-photonics, biophotonics, optical system and network technology, and lightwave systems technology.

➢ Communications Group

Our research interests include the design and analysis of a wide variety of communication systems such as next-generation cellular systems (e.g., 5G systems), wired networks, wireless networks, broadcasting systems, sensor networks, storage systems, and computing systems. We seek to characterize the fundamental limits of information flow for diverse networks, as well as to develop practical transmission/reception schemes that can actually achieve the limits. We are also interested in extending the principles developed in communication networks into other fields of network research. Especially we are recently doing interdisciplinary research on world-wide important topics such as the smart energy network (the so-called smart grid), the smart health-care network, and the smart environment system.

➢ Computing, Networking, and Security Group

The Computing, Networking, and Security (CNS) group focuses its research and education efforts on the hot topics in computer systems, networking, big data analytics, artificial intelligence and algorithms, and system security. Its goal is to lead the global research community on the recent hot issues in computing and networking technologies, and to educate the students to become global innovators in this area. Its research topics include operating systems and system software, networking theory and algorithms, networked systems design and implementation, cloud computing, big data analysis and algorithms, artificial intelligence and algorithms, smart grid systems, smart mobile systems and so on.

➢ Signals and Systems Group

The Signals and Systems Group researches core theories and algorithms for the development of signal and information processing algorithms, as well as for the design and implementation of diverse applications. Its areas of research can be divided into three broad categories: intelligent information systems, control systems, and brain-IT. In the area of intelligent information systems, the group carries out research on information and signal processing that involves voice/audio, image/video, and multimedia. Specifically, it focuses on voice synthesis and coding, intelligent signal processing and prediction, machine learning and deep learning, computer vision, pattern recognition, multimedia processing, digital mobile communication, data protection, signal detection and prediction, and 3D image/video processing. Research related to control systems is focused mainly on robots, power electronics, and control theories used in various intelligent systems and industrial systems. To create an intelligent environment for humankind, the examination of process control systems, production line automation, satellite systems, intelligent traffic control systems, power conversion systems, human-centric welfare robots, personal robots, artificial life, inter-robot collaboration, human-robot interfaces, and empathetic robots are included. Researches related to the brain IT includes brain image analysis, functional magnetic resonance imaging, brain connectivity, brain mimic robot design, and brain science and IT convergence.