

İTÜ Seminar

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Research, Innovation, and Commercialization of Optics and MEMS

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Abstract:

Lasers, optics and micro-electro-mechanical systems (MEMS) is a powerful combination. In this talk I'll describe three optical MEMS applications developed in our laboratory during the past decade. I'll primarily focus on the research and also mention the patents and the commercialization activities.

(i) Label-free biosensing offer important advantages for point-of-care diagnostics due to its simplicity. We developed a biosensor platform technology platform where nickel-based MEMS cantilevers are placed in a disposable microfluidics cartridge with no electrical connections. Our current focus is on commercialization of this technology for coagulation time measurements using serum and whole blood in a portable platform.

(ii) Uncooled thermal imaging is an important technology developed initially for defense applications but recently has found other applications in medical diagnostics and automotives. We designed MEMS based pixels to absorb thermal radiation and bend in response to heating. The detection is using a remote laser and grating interferometer integrated underneath each pixel, which offer excellent sensitivity. We exploited both CCD camera based readout and integrated CMOS readout. CMOS readout IC is post-processed to open through silicon via holes next to each pixel to allow laser light before integration with the MEMS detector array.

(iii) MEMS scanners have advanced rapidly during the last 20 years thanks to the excellent mechanical and optical properties offered by silicon. Our group has been at the forefront of this development and contributed to the development of mobile pico-projectors products. I'll discuss some of the emerging 3D and interactive Augmented-Reality display applications enabled by pico-projectors and MEMS scanners. Those technologies are expected to play an important role in the future of human-computer interface.

Biography:

Hakan Urey is a Professor of Electrical Engineering at Koç University in Istanbul-Turkey. He was a visiting Professor at Cavendish Lab, Cambridge University, UK and Bogazici University, Istanbul during 2013. He received the BS degree from Middle East Technical University, Ankara, in 1992, and MS and Ph.D. degrees from Georgia Institute of Technology in 1996 and in 1997, all in Electrical Engineering. After completing his PhD, he joined Microvision Inc., in Seattle area and played a key role in the development of MEMS and micro-optics technologies for Laser Scanning Displays. He was the Principal System Engineer when he left Microvision in 2001 to join the faculty of engineering at Koç University, where he established the Optical Microsystems Research Laboratory (OML). His current research projects are in the areas of wearable and 3D displays, micro-optical screen technologies, MEMS scanners, MEMS biosensors, MEMS thermal imaging sensor arrays, and MEMS spectrometers.

He has more than 40 issued and pending patents, which have been licensed by 5 different companies for commercialization and resulted in 2 spinoff companies. He has more than 150 papers published in international journals and conference and has given more than 20 invited presentations at international conferences. He received the Werner Von Siemens faculty excellence award in 2006, TÜBA (Turkish Academy of Sciences) Distinguished Young Scientist award in 2007, Encouragement award from the Turkish Scientific and Technical Research Council (TUBITAK) in 2009, Outstanding Faculty award from Koc University in 2013, and European Research Council Advanced Grant (ERC-AdG) in 2013 to develop next generation wearable and 3D display technologies.