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Advanced Optical Metrology and Fabrication using Mode-locked Lasers

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Abstract:

Precision is a common aspect that governs most of today's leading-edge technologies including IT, BT, NT and aerospace technology. In response to ever-growing demands on precision, various laser sources have been used to attain sub-wavelength precision in many fields of fabrication and metrology by means of photons. This precision-directed laser-based photonics will continue to advance to the direction of ultraprecision to achieve better resolutions, larger functional ranges, higher throughputs, and more improved stability. Nonetheless, the light sources available today are limited in the wavelength bandwidth, photon energy, spatial and temporal coherence, and peak power, which consequently hinders breakthroughs toward the realm of ultraprecision. The research objective of the Precision Engineering & Metrology Group at KAIST is to investigate the technological possibilities of ultrashort mode-locked lasers with the aim of establishing the new foundations for ultraprecision that will enable nano-fabrication and distance and dimensional metrology over extensive ranges as demanded in the next generation of precision engineering. To the end, a systematic approach will be pursued to generate noble coherent light sources covering the broad optical spectrum spanning from THz waves, infrared, visible to extreme violet light radiation by making the most of ultrafast femtosecond laser pulses.

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Current Appointments:

Professor, Department of Mechanical Engineering, KAIST, 1985.5 - present
Director, Ultra-fast Optics for Ultra-precision National Research Group, 2008.6 - present

Past Important Appointments:

Director, KAIST Institute of Optical Science & Technology, KAIST, 2007.11 – 2015.12
Dean, School of Mechanical & Aeronautical Engineering, KAIST, 2008.6 – 2012.2
President, Korea Society of Precision Engineering (KSPE), 2011.1 – 2011.12

Educations:

PhD in Precision Engineering, 1981-1984, Cranfield University, United Kingdom
MSc in Mechanical Engineering, 1978-1980, KAIST, Daejeon, South Korea
BSc in Mechanical Engineering, 1974-1978, Seoul National University, South Korea

Biography

Seung-Woo Kim obtained his bachelor degree in Mechanical Design from Seoul National University in 1978, and received his MS degree in Mechanical Engineering from the Korea Advanced Institute of Science and Technology (KAIST) in 1980. He went over to United Kingdom in 1981 for further study and obtained his Ph.D. degree in Precision Machine Systems Design from Cranfield University in 1984. He came back to Korea and started his carrier as a scholar by joining KAIST in 1985. Since then, in the Department of Mechanical Engineering, he has been teaching undergraduates and leading a research group of graduate students working in the field of precision engineering and optical metrology. As a tenured full-professor, he is currently assuming the responsibility of director of the KAIST Institute of Optical Science & Technology which was established in 2008 to promote interdisciplinary collaborations on the new emerging field of ultrafast photonics beyond departmental boundaries between physics, chemistry, biology, telecommunication and precision mechanics.

His professional interests are precision optical technology with specialty on optical-mechanics system synthesis for precision machines design, optical interferometry for 3-D surface and thin-film metrology, and ultrafast photonics for nano-scale fabrication and ultra-precision measurements. During last three decades he has published ~150 technical papers in peer-reviewed journals, ~240 presentations in conferences, and ~50 patents. He has been working as principal investigator for numerous national and industrial research projects and currently involved in an important national creative research initiative project for the development of next generation precision engineering key technologies using femtosecond pulse lasers. He has also actively been involved in international academic societies for organizing on-time conferences for leading-edge precision engineering optical technologies. He was president of the Korea Society of Precision Engineering (KSPE) during the term of 2011 and is currently a member of OSA (Optical Society of America), SPIE (International Society of Optical Engineering), CIRP (International Academy for Production Engineering), and euspenn (European Society Precision Engineering).