IBS CINAP Seminar

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Soft Material-based Micro-Robotics and Triboelectric Nanofabrication

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Abstract: The advent of facilely processable polymeric soft materials has strongly impacted the fields of MEMS and NEMS, establishing the exciting new sub-fields of soft-MEMS and soft-NEMS. Currently, the researchers in those fields are well beyond producing just the softer versions of existing devices and vigorously marching forwards to create totally new devices with the deformability considered from their inceptions.

This talk will present some recent examples of such "deformation-critical" soft-MEMS & NEMS developed in the presenter's lab. His research has consistently demonstrated that PDMS, the flagship material for soft-MEMS and NEMS best known for its softness, can be machined into surprisingly robust and highly versatile micro/nanoscale devices with the help of various unconventional fabrication techniques.

The presenter applied the principle to deformable optics and micro-robotics, producing upright PDMS micropillars with record-high aspect-ratios and microscale pneumatic robot-arm that can mimic the multi-turn spiraling motion of biological tentacles. Using the deformational interaction of soft PDMS with rigid nanostructures, the presenter has also shown that triboelectric surface charge can be induced on PDMS surfaces in a highly organized, nanoscale patterned fashion. Utilization of such a nanopatterned surface charge for nanomanufacturing will also be demonstrated.

Brief Bio

Jay Kim received his Ph.D. degree in Electrical Engineering from the University of Michigan at Ann Arbor in 2003 with thesis research on nonlinear & integrated optics. For his postdoctoral study, he joined Berkeley Sensor & Actuator Center at the University of California at Berkeley where he studied bio-inspired optical systems and plasmonic nanostructures. In 2006, he joined the Electrical & Computer Engineering Department of Iowa State University where he is currently an associate professor. His current research interests include soft material-based MEMS & NEMS, nanofabrication, and bio-inspired microsystems. Prof. Kim is the recipient of NSF's Faculty Early Career Development Award (2010) and Air Force Summer Faculty Fellowship (2009). He also received Warren B. Boast Undergraduate Teaching Award (2008) and Harpole-Pentair Developing Faculty Award (2009-2010).

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