Stretchable transducers for soft robotics and energy harvesting

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Overview

Stretchable transducers consist of soft and compliant materials that allow electrical and mechanical energy to be converted interchangeably. Subject to a mechanical force, soft materials are capable of being compressed, flexed, bent or stretched. Similarly, subject to electrical stress, these soft materials are also capable of responding mechanically by the same four modes of deformation. Both nature and science has demonstrated the excellent energy conversion capability of soft materials in small packages. The high energy density exhibited in soft materials allows actuators, sensors and even energy harvesters to be designed as small and portable systems, much like natural muscles and biological skin.

This course begins with the basics of stretchable transducers. We use dielectric elastomers for our discussion. Dielectric elastomers consist of a soft dielectric membrane, sandwiched between compliant conductors. The soft and compliant nature of this assembly allows dielectric elastomers to be easily deformed, thereby functioning as a deformable capacitor under an electric field. Electric stress from an electric field would thus be large enough to mechanically deform the material significantly, allowing it to function as an actuator. Any mechanical deformation would be manifested as capacitance change, enabling the material to sense deformation by change in electrical signal. The capability of dielectric elastomers to deform with strains in excess of 100% allows it to exhibit very large change in capacitance. This imparts the dielectric elastomers with an additional function – to be a charge pump. Cyclic mechanical deformation would cause electric charges to be pumped from a low electrical potential, to a high electrical potential. Electrical amplification as a result of mechanical deformation thus allows it to harvest mechanical energy like ocean waves, human motion, vehicular motion, etc.

We shall demonstrate analysis-inspired prototypes for soft robotics, stretchable energy harvesters and sensors. Participants of the course will also have to opportunity to perform hands-on work on the experimentation and construction of simple dielectric elastomer based prototypes.

Modules	**A: Basic theory and mechanics of dielectric elastomers as stretchable transducers** **B: Practical designs and fabrication of prototypes** **Course Duration: May 7 - May 11, 2018** **Number of participants for the course will be limited to fifty (50).**
You Should Attend If…	• Executives, practicing engineers, researcher and scientists from R&D laboratories and Industries engaged in solving multidisciplinary problems in the field of robotics, mechatronics and energy • B. Tech./M. Tech./Ph.D. students and faculty members from academic institutions interested in learning basic theory, mechanism, design and fabrication of stretchable transducers for robotics, mechatronics and renewable energy applications.
Fees	The participation fees for taking the course is as follows: **Participants from abroad: US $300** **Industry: Rs. 6000/-** **Faculty: Rs. 3000/-** **Student: Rs 1000/-** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Prof. Adrian Koh is an Assistant Professor of Mechanical Engineering at the National University of Singapore (NUS). He received his PhD degree in Integrative Sciences & Engineering at NUS, under the Agency for Science, Technology and Research (A*STAR) Graduate Scholarship. He worked as a Design Engineer, and was involved in projects like the Singapore Changi Airport Terminal 3 and the Mass Rapid Transit Rail designs. He was a post-doctoral fellow at Harvard University, where he started his current research on soft active materials. He was awarded the *EAPromising International Researcher Award* in 2013, at the third International Conference on Electromechanically-Active Polymer transducers and artificial muscles, held in Zurich, Switzerland. He is also a reviewer of several EU-based Electroactive Polymer (EAP) projects since 2012.

Prof. Karali Patra is an Associate Professor of Mechanical Engineering at Indian Institute of Technology Patna. His research interests include soft and stretchable smart materials based actuators and energy harvesting systems, modeling and analysis of micromachining processes for difficult to machine materials and smart materials. He and his group are currently working on the development of stretchable actuators and generators using electroactive polymers for micro/meso pumps and motion based energy harvesters, respectively.

For Registration

Register at GIAN site: http://www.gian.iitkgp.ac.in/GREGN and sent application with fees to course coordinator.
Deadline for submitting application: 15th April, 2018
Notification of acceptance: 25th April, 2018

Boarding & Lodging

Limited accommodation is available in the Institute Guest house/ Hostels for a very limited number of participants on payment as per actual and with advance request.

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Course Coordinator

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