Abstract

Shape-shifting soft robotic structures into programmed shapes and volumes can reconcile the physical shape and the overall functionality providing revolutionary approaches in a wide range of applications including robotics, electronics, and biomedical technologies. This talk will present my research activities on how to design and manufacture shape memory materials based soft actuators, robots, and shape-shifting structures. First, shape memory alloy based soft actuators with various deformation are proposed and demonstrated for soft biomimetic robots and structures. Next, soft actuators with variable stiffness are proposed which relies on the embedded low-melting point materials or phase change materials, and these actuators are capable of both shape-shifting and of shape-retaining in multiple configurations. Moreover, various soft deployable structures composed of simple and identical soft actuators are developed where the entire compact structure can pop up into a much larger, load-bearing structure. Meanwhile, modular assembly method is also proposed for building soft deployable structures composed of identical soft deployable modules using embedded magnetic elements for the rapid assembly and disassembly. The soft deployable robot for the first time being
capable of both deploying itself and of movement without additional motors will be introduced. This robot can serve as the first step toward a new class of soft robots that is modular, self-deploying, and capable of locomotion “out of the box.” Lastly, using 3D printing and mechanical assembly approaches, shape memory polymer based shape-shifting structures with programmable deformation are proposed and demonstrated for multiple applications.

About the Speaker

Wang, Wei received his B.S. and M.S. degrees in Mechanical Engineering from Harbin Institute of Technology (HIT), China, in 2008 and 2011, respectively, and the Ph.D. degree in Mechanical Engineering from Seoul National University (SNU), Korea, in 2016. He was a postdoctoral fellow at SNU between March 2016 and February 2018. Currently, he is an assistant research professor in the Department of Mechanical Engineering at SNU, Korea. His research interests include soft actuators and robots, biomimetic robots, and smart materials and structures.

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All are Welcome!

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