

Shape-Shifting Soft Robots that Adapt to Changing Tasks and Environments

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Soft robots have garnered interest due to their potential ability to be robust to impacts and falls, conform to the human body without restriction on the natural mechanics of motion, grasp delicate and diverse objects, and embed safety at the material level as a path toward human-safe co-robotics. Furthermore, soft robots have the potential to adapt their morphology, properties, and behavioral control policies towards different tasks or changing environments. This adaptive capability is often inspired by biological systems. For example, some spiders and caterpillars transition from walking gaits to rolling to escape predation. Across larger timescales, caterpillar-to-butterfly metamorphosis enables land-to-air transitions, while mobile to sessile metamorphosis, as observed in sea squirts, is accompanied by radical morphological change. During this talk, I will present an overview of shape-shifting soft robotic platforms, as well as the multifunctional material developments that enable synthetic morphing capabilities. Finally, I will speculate on the opportunities and challenges related to blurring the lines between functional components and realizing system intelligence through intrinsic, somatic computation.

Bio: Rebecca Kramer-Bottiglio is the John J. Lee Assistant Professor of Mechanical Engineering and Materials Science at Yale University. Focusing on the intersection of materials, manufacturing, and robotics, her group is deriving new multifunctional materials that will allow next-generation robots to adapt their morphology and behavior to changing tasks and environments. A recipient of early career awards from NSF, NASA, AFOSR, and ONR, she was named to Forbes' 30 under 30 list for her approach to manufacturing liquid metals through printable dispersions and scalable sintering methods, and she received the PECASE award for her development of robotic skins that turn inanimate objects into multifunctional robots. She serves as an Associate Editor of Soft Robotics, Frontiers in Robotics and AI, Multifunctional Materials, and Transactions on Robotics, and is an IEEE Distinguished Lecturer. She also serves on the Technology, Innovation & Engineering Committee of the NASA Advisory Council.

