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Giant linear voltage-induced deformation of a dielectric elastomer actuator JIAN ZHU, School of Engineering and Applied Sciences, Harvard University, MATTHIAS KOLLOSCHE, GUGGI KOFOD, University of Potsdam, Germany, ZHIGANG SUO, School of Engineering and Applied Sciences, Harvard University — For dielectric elastomers, one of the most conspicuous attributes is large deformation of actuation induced by voltage. However, electromechanical instability may limit their deformation. In this seminar, I will illustrate how dielectric elastomers survive or eliminate electromechanical instability, through mechanical designs. For example, I will analyze a dielectric elastomer with a "pure shear" boundary condition. The membrane is first prestretched along the transverse direction, and then fixed by a rigid bar. As a result, the stretch in transverse direction is fixed, and the membrane can only be actuated along the vertical direction. The theory shows that the actuator can avert electromechanical instability, and achieve a giant linear deformation of actuation. The experiments confirm the theoretical predictions. For SEBS material, the linear strain of actuation can be 80%. For VHB material, the linear strain of actuation can be 300%. The actuator shows advantages compared to the classic designs (say, tube and circular actuators), and can be used as artificial muscles in soft robots.

Jian Zhu
School of Engineering and Applied Sciences, Harvard University

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