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Splitting of neutral mechanical plane of conformal, multilayer piezoelectric mechanical energy harvester subject to euler buckling

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Flexible piezoelectric mechanical energy harvesters (MEHs) are of recent interest as an important emerging variant of traditional piezoelectric devices. The design of stacking multilayer MEHs with adhesive in between is an effective way to enhance the magnitude of power generation. Here, we present an analytic model to study the mechanical behavior of the multilayer MEHs based on lead zirconate titanate (PZT) subject to Euler buckling. It is found that different from the plane section of the whole stack, thick and soft adhesives serve as shear lags while each Polyimide (PI) layer holds plane section of its own, in which case the neutral planes is split into multiple. The deformation is almost the same, for each PI layer, as well as PZT arrays, which is a very useful to avoid the premature failure of devices. Extreme cases and the transition are all captured quantitatively with a uniform analytic model and verified by the finite element method (FEM). A dimensionless parameter is obtained to characterize the degree of the splitting of neutral mechanical plane, which is helpful for the design of the multilayer PZT MEHs.

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Dielectric elastomer structures with integrated function of actuating and sensing

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In this paper we present a novel structure with integrated function of actuating and sensing with dielectric elastomer (DE) and elastomeric frames. The structure can deform when subjected to high voltage loading and generate corresponding output signal in return. We investigate the basic physical phenomenon of dielectric elastomer experimentally. It is noted that when applying high voltage, the actuating dielectric elastomer membrane deforms and the sensing dielectric elastomer membrane changes the capacitance in return. Based on the concept, finite element simulation has been conducted to further investigate the electromechanical behavior of the structure. In addition, various patterns of electrodes can be printed on the dielectric elastomer membrane to increase the resolution of the sensing part of the structure.

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神经导管应用中制造工艺与生物医学研究

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以新型神经导管制备为典型案例，着重研究了神经导管加工过程中的稳定性，构建了固态和液态失稳模型。介绍了神经导管材料机械强度调控、细胞成活率等制备过程中的科学问题。对神经导管的作用机理进行了探索。通过神经细胞生长实验，初步验证了神经导管内壁沟槽结构对神经生长的促进作用，并构建物理模型分析了神经导管内壁沟槽结构的作用机理。

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