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Instabilities In Dielectric Elastomer Plates HADRIEN BENSE, CNRS, JOS BICO, BENOT ROMAN, ETIENNE REYSSAT, PMMH, UMR7636 ESPCI, MIGUEL TREJO, Gulliver UMR 7083 ESPCI — Dielectric elastomers are soft capacitors whose electrodes undergo planar extension when stimulated by an electric voltage. Potential applications are numerous, ranging from sensors to actuators, displays or even energy harvesting systems. In most cases the elastomer is strongly stretched and clamped. Here, we investigate the effect of a spatially non uniform voltage on a non prestrained system. We find that the membranes under non-uniform load undergo mechanical instabilities. Such buckling-like instabilities are not observed in other studies because of large tensile loading, but they are common in thin plates with internal stresses (such as non-uniform plastic deformation in a torn ductile plate or differential growth in hydrogels). As a first step, we propose to study simple geometries: a disk where only the central zone or a peripheral annulus is growing would be a first example. These systems, despite their apparent simplicity, display surprising features. Predicting the threshold of buckling and the main characteristics of the pattern (wavelength, extension) is complex, even in simple geometries. Non-linear analysis is necessary to capture, at least qualitatively, the behavior of of such systems from the buckling threshold to the evolution of the observed patterns.

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