Likely instabilities in stochastic elastic solids

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The study of material elastic properties has traditionally used deterministic approaches, based on ensemble averages, to quantify constitutive parameters. In practice, these parameters can meaningfully take on different values corresponding to possible outcomes of the experiments. From the modelling point of view, stochastic representations accounting for data dispersion are needed to improve assessment and predictions. In this talk, I will discuss stochastic-elastic material models described by a strain-energy density where the parameters are characterised by probability distributions at a continuum level. To answer important questions, such as "what is the influence of the probabilistic parameters on the predicted elastic responses?" and "what are the possible equilibrium states and how does their stability depend on the material constitutive law?", I will consider the cavitation and finite amplitude oscillations of hyperelastic spheres, and the soft elasticity of liquid crystal elastomers. These problems, for which the solution is tractable analytically, can offer significant insight into how stochastic-elastic models can be integrated into the nonlinear field theory. Similar approaches can be developed for other mechanical systems.

Dr Angela Mihai is a Reader (Associate Professor) in Applied Mathematics at Cardiff University, Wales, UK, where she has been on the faculty since 2011. She received her PhD for research in numerical analysis from the University of Durham, UK, in 2005, then worked as a postdoctoral researcher at the Universities of Strathclyde, Cambridge, and Oxford, where she developed her expertise in nonlinear elasticity. Her research is in applied and computational mathematics at the interface with physical, engineering and life sciences. Her primary expertise is in the mathematics of solid mechanics, including multiscale modelling, limit states analysis, optimisation, and uncertainty quantification.