Geometric Singular Perturbation Analysis of a Model for Micro-Electro Mechanical Systems (MEMS)

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Many technological devices commonly used today rely on Micro-Electro Mechanical Systems (MEMS). These are defined as very small structures combining electrical and mechanical components on a common substrate to perform several tasks. Their application in various fields such as medicine, transport industry and communications has raised considerable scientific interest.

The aim of this talk is to give a general introduction on the electrostatic-elastic case, where an elastic membrane is allowed to deflect above a ground plate under the action of an electric potential. This situation can be mathematically described by a parabolic PDE with a particular nonlinear source term that can lead to the "touchdown phenomenon". Mathematically, touchdown causes non existence of steady states and/or finite time blow-up of solutions. A recently proposed model depending on a small "regularization" parameter ε is introduced, where considering additional insulating effects allows to avoid singularities. We use tools from geometric singular perturbation theory and blow-up methods to study the bifurcation of steady-state solutions, emphasizing the interplay between the parameters appearing in the model. In particular, we focus our attention on the singular limit as these small parameters tend to zero.