A Free Boundary Problem Modeling Electrostatic MEMS

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Idealized microelectromechanical systems (MEMS) consist of a fixed ground plate above which a membrane is suspended deforming due to a voltage difference that is applied between the two components. The mathematical model involves the harmonic electrostatic potential in the free domain between ground plate and membrane along with a singular evolution equation for the membrane displacement, the coupling term being the trace of the potential gradient on the membrane. The number of steady-state solutions and the possible phenomenon of a touchdown of the membrane on the ground plate are analyzed.