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Oscillations of a capillary switch used as a miniature opto-fluidic device SANTHOSH RAMALINGAM, OSMAN BASARAN, Purdue University, West Lafayette — A capillary switch (CS) is a continuous volume of liquid consisting of a sessile and a pendant drop that are coupled through a liquid filled hole in a plate. When capillary force is much larger than body forces such as gravity, this simple, coupled interfacial system exhibits multiple equilibrium states beyond a critical volume. Owing to its extremely small size, and hence large curvature and highly spherical air-liquid interface, an oscillating CS can potentially be used as a variable focus liquid lens in MEMS devices. The dynamics of an oscillating CS are studied by solving the full 3D axi-symmetric or 2D Navier-Stokes equation using the Galerkin finite element method (G/FEM). Applying means of forcing such as oscillating the pressure in the gas surrounding the sessile (pendant) drop and vibrating the plate, modes of oscillation are identified from resonances observed during frequency sweeps. The shift in the frequencies of oscillation of lower modes due to changes in parameters such as liquid volume, plate thickness, and liquid viscosity and surface tension are also studied. Results are shown to agree well with experimental observations by Hirsa and coworkers.

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