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Oscillations of an asymmetric double droplet system SANTHOSH RAMALINGAM, OSMAN BASARAN, Purdue University — When a small cylindrical hole in a plate is overfilled with a liquid, a double droplet system (DDS) is created, consisting of a sessile (top) drop and a pendant (bottom) drop. For small hole radii, R, equilibrium shapes of both drops are sections of spheres. Due to the drops' spherical surfaces and its miniature size, a DDS serves well as a micro lens and a DDS oscillating about its equilibrium shape can be used as a fast focusing lens. In this talk, we consider a DDS consisting of an isothermal, incompressible Newtonian liquid of constant density and constant viscosity that is surrounded by a gas and where the air-liquid surface tension is constant. Exciting the DDS by oscillating in time (a) the pressure in the gas surrounding either drop (pressure excitation), (b) the plate perpendicular to its plane (axial excitation), and (c) the hole radius (radial excitation), the natural modes of oscillation are identified from resonances during frequency sweeps. Here, we study numerically, using the Galerkin finite element method, the oscillation modes of a DDS in which the combined volume of the pendant and sessile drops is greater than the critical volume corresponding to that of a sphere of radius R. The frequencies are shown to accord well with experimental observations and, in the limit of vanishing plate thickness and negligible viscous effects, the mode shapes and frequencies are also shown to agree with theoretical predictions.

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