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Equilibrium shapes and stability of a coupled interface system consisting of a liquid bridge and a pendant drop SANTHOSH RAMALINGAM, OSMAN BASARAN, Purdue University — A capillary switch, which is a continuous volume of liquid where a sessile drop is connected to a pendant drop through a liquid-filled circular hole in a plate, is an example of a coupled interface system, i.e. a sessile and a pendant drop. In certain microfluidic applications involving transport of small liquid volumes, the sessile drop of the switch is grown at the expense of the pendant drop so that it coalesces with a second pendant drop hanging from a rod placed above the plate. The result is another coupled interface system wherein a liquid bridge is now connected to a pendant drop through the circular hole in the plate. Here, we investigate the equilibrium shapes and stability of this coupled interface system. The equilibrium shapes are determined numerically by finite element analysis and families of equilibrium shapes are tracked using first order continuation. Shape stability is determined by (i) exploiting the connectivity of the shape families and (ii) tracking numerically the fate of volume preserving perturbations by a transient hydrodynamic analysis. Locations of turning and bifurcation points are identified as functions of system volume, pressure difference between the gas phases above and below the plate, and bridge height.

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