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Analysis and Numerical Simulation of EWOD of a Droplet for Application in a Variable Focus Microlens YUAN-JEN CHANG, KAMRAN MOHSENI, VICTOR BRIGHT, University of Colorado at Boulder — Modification of the curvature of the interface between a conductive (water) and isolating (oil) liquids is used in order to design a tunable microlens. Electrowetting on Dielectric (EWOD), the modification of surface energy of a conductive droplet on an isolated electrode, is employed in order to change the interface curvature and tune the microlens. Several features of the microlens design are addressed. These includes: the drop-centering mechanism, matching of the density of the two immiscible liquids, refractive indexes of the two liquids, and planar electrodes for electrowetting. A dimensional analysis is performed to identify the relevant nondimensional parameters. Direct numerical simulation of the hydrodynamic and electric fields is carried out. It is found that the focal length of the microlens changes continuously from negative to positive by applying a voltage from 0 to 200 volts. The focusing speed of the microlens is calculated to be around 10 milli-seconds. A successfully fabricated microlens device has been demonstrated.

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