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Dynamics of pinned-contact oscillating gas/liquid lenses AMIR HIRSA, BERNARD MALOUIN, JOSEPH OLLES, Rensselaer Polytechnic Institute, CARLOS LOPEZ, Intel Corp., MICHAEL VOGEL, Cornell University —

Liquid lenses are a natural solution for applications in adaptive optics requiring a fast response. Existing liquid lenses use large disturbances to overcome liquid inertia and subsequently utilize the lens after the oscillations have dampened. An alternate strategy was demonstrated recently: a harmonically-driven liquid lens with an oscillating focal length that allows the capture of any plane in a given range by grabbing the image 'in sync' with the oscillations. Hence, by continuously oscillating the lens, the task of changing the focal length is effectively transformed from a mechanical manipulation to the electronic timing of image capture by the sensor, which can be achieved much faster. Good optical quality is possible by designing the liquid lens to traverse states where capillarity produces spherical interfaces. Energy efficiency is achieved through pinned contact lines and operation at resonance. We present experimental results along with predictions for the dynamics of such oscillatory driven lenses, including the effects of liquid volume, driving frequency and amplitude on droplet shapes and resultant optical characteristics. High fidelity imaging was demonstrated at 100 Hz for a millimeter scale liquid lens.

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