Abstract Submitted
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Hydrodynamic Forces on Microbubbles under Ultrasound Excitation[1] ALICIA CLARK, ALBERTO ALISEDA, University of Washington — Ultrasound (US) pressure waves exert a force on microbubbles that can be used to steer them in a flow. To control the motion of microbubbles under ultrasonic excitation, the coupling between the volume oscillations induced by the ultrasound pressure and the hydrodynamic forces needs to be well understood. We present experimental results for the motion of small, coated microbubbles, with similar sizes and physico-chemical properties as clinically-available ultrasound contrast agents (UCAs). The size distribution for the bubbles, resulting from the in-house manufacturing process, was characterized by analysis of high magnification microscopic images and determined to be bimodal. More than 99% of the volume is contained in microbubbles less than 10 microns in diameter, the size of a red blood cell. The motion of the microbubbles in a pulsatile flow, at different Reynolds and Womersley numbers, is studied from tracking of high-speed shadowgraphy. The influence of ultrasound forcing, at or near the resonant frequency of the bubbles, on the hydrodynamic forces due to the pulsatile flow is determined from the experimental measurements of the trajectories. Previous evidence of a sign reversal in Saffman lift is the focus of particular attention, as this is frequently the only hydrodynamic force acting in the direction perpendicular to the flow pathlines. Application of the understanding of this physical phenomenon to targeted drug delivery is analyzed in terms of the transport of the microbubbles.

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