Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The hydrodynamic and ultrasound-induced forces on microbubbles under high Reynolds number flow representative of the human systemic circulation ALICIA CLARK, ALBERTO ALISEDA, University of Washington Department of Mechanical Engineering — Ultrasound contrast agents (UCAs) are micron-sized bubbles that are used in conjunction with ultrasound (US) in medical applications such as thrombolysis and targeted intravenous drug delivery. Previous work has shown that the Bjerknes force, due to the phase difference between the incoming US pressure wave and the bubble volume oscillations, can be used to manipulate the trajectories of microbubbles. Our work explores the behavior of microbubbles in medium sized blood vessels under both uniform and pulsatile flows at a range of physiologically relevant Reynolds and Womersley numbers. High speed images were taken of the microbubbles in an in-vitro flow loop that replicates physiological flow conditions. During the imaging, the microbubbles were insonified at different diagnostic ultrasound settings (varying center frequency, PRF, etc.). An in-house Lagrangian particle tracking code was then used to determine the trajectories of the microbubbles and, thus, a dynamic model for the microbubbles including the Bjerknes forces acting on them, as well as drag, lift, and added mass. Preliminary work has also explored the behavior of the microbubbles in a patient-specific model of a carotid artery bifurcation to demonstrate the feasibility of preferential steering of microbubbles towards the intracranial circulation with US.

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Date submitted: 01 Aug 2016 Electronic form version 1.4