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Jetting of a ultrasound contrast microbubble near a rigid wall[1]

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Micron sized gas-bubbles coated with a stabilizing shell of lipids or proteins, are used as contrast enhancing agents for ultrasound imaging. However, they are increasingly being explored for novel applications in drug delivery through a process called sonoporation, the reversible permeabilization of the cell membrane. Under sufficiently strong acoustic excitations, bubbles form a jet and collapse near a wall. The jetting of free bubbles has been extensively studied by boundary element method (BEM). Here, for the first time, we implemented a rigorous interfacial rheological model of the shell into BEM and investigated the jet formation. The code has been carefully validated against past results. Increasing shell elasticity decreases the maximum bubble volume and the collapse time, while the jet velocity increases. The shear stress on the wall is computed and analyzed. A phase diagram as functions of excitation pressure and wall separation describes jet formation. Effects of shell elasticity and frequency on the phase diagram are investigated.

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