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Dynamics of a Cylindrical Bubble between Two Parallel Plates for Biomedical Applications SOWMITRA SINGH, JIN-KEUN CHOI, GEORGES CHAHINE, Dynaflow, Inc. — Microbubbles have been shown to produce directional and targeted membrane poration of individual cells in microfluidic systems, which could be of use in ultrasound-mediated drug and gene delivery. To study and understand the mechanisms at play in such interactions, a full three- dimensional Boundary Element Method (BEM) has been developed to describe complex bubble deformations, jet formation, and bubble splitting. The present work aims at providing analytical validation for the three-dimensional BEM code, 3DynaFS©, when the dynamics of a bubble between two parallel plates is studied. The analytical equations of a cylindrical (2-D) bubble between two flat plates were derived without accounting for any shape deformation. Comparisons between the analytical model and the numerical model were carried out in scenarios where the shape of an expanding/collapsing bubble between two parallel plates is nearly cylindrical (large maximum equivalent bubble radius to plate gap ratio). Interestingly, both the analytical and the numerical methods predict a strong dependence of the bubble period on the plate size.

Jin-Keun Choi
Dynaflow, Inc.

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