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Numerics of surface acoustic wave (SAW) driven acoustic streaming and radiation force NITESH NAMA, Pennsylvania State Univ, RUNE BARNKOB, CHRISTIAN KAHLER, Bundeswehr University Munich, FRANCESCO COSTANZO, TONY JUN HUANG, Pennsylvania State Univ —
Recently, surface acoustic wave (SAW) based systems have shown great potential for various lab-on-a-chip applications. However, the physical understanding of the precise acoustic fields and associated acoustophoresis is rather limited. In this work, we present a numerical study of the acoustophoretic particle motion inside a SAW-actuated, liquid-filled polydimethylsiloxane (PDMS) microchannel. We utilize a perturbation approach to divide the flow variables into first- and second-order components. The first-order fields result in a time-averaged acoustic radiation force on suspended particles, as well as the time-averaged body force terms that drive the second-order fields. We model the SAW actuation by a displacement function while we utilize impedance boundary conditions to model the PDMS walls. We identify the precise acoustic fields generated inside the microchannel and investigate a range of particle sizes to characterize the transition from streaming-dominated acoustophoresis to radiation-force-dominated acoustophoresis. Lastly, we demonstrate the ability of SAW devices to tune the position of vertical pressure node inside the microchannel by tuning the phase difference between the two incoming surface acoustic waves.

Nitesh Nama
Pennsylvania State Univ

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