Different origins of acoustic streaming at resonance

Acoustic streaming is a nonlinear phenomenon that plays an essential role in microscale acoustofluidic devices for handling of sub-micrometer particles. However, the streaming patterns observed in experiments can be of complicated and non-intuitive character, and therefore, experiments, and device optimization are often carried out in a trial-and-error manner. To overcome this obstacle, we classify acoustic streaming based on our recently developed theory of acoustic streaming. Using this theory we have shown that acoustic streaming is driven partly by Reynolds stresses in the bulk and partly by a slip-velocity condition at the walls due to Reynolds stresses in the acoustic boundary layers. Hence, in our classification, we distinguish between boundary-layer-driven and bulk-driven streaming. For boundary-layer-driven streaming at resonance, we classify the two physically relevant limits of parallel and perpendicular acoustics as well as the intermediate range. For bulk-driven streaming we find that the acoustic intensity vector plays a central role, and that this quantity can give rise to a strong bulk-driven streaming, if the acoustic fields have large angular momentum. In this context, we analyze mechanisms that can lead to rotating resonant modes in acoustic microchannels.

General information
Publication status: Published
Organisations: Department of Physics, Biophysics and Fluids
Corresponding author: Bruus, H.
Contributors: Bach, J. S., Bruus, H.
Number of pages: 5
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Meetings on Acoustics. Proceedings
Volume: 34
Issue number: 1
Article number: 022005
ISSN (Print): 1939-800X
Ratings:
Scopus rating (2018): CiteScore 0.37 SJR 0.213 SNIP 0.235
Original language: English
Electronic versions:
2.0000927.pdf. Embargo ended: 05/04/2019
DOIs:
10.1121/2.0000927
Source: FindIt
Source-ID: 2442217661
Research output: Contribution to journal › Conference article – Annual report year: 2018 › Research › peer-review