Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Dynamics of an elastic sphere containing a thin creeping region and immersed in an acoustic region for similar viscous-elastic and acoustic time- and length-scales[1] AMIR GAT, YONATHAN FRIEDMAN, Technion - Israel Institute of Technology — The characteristic time of low-Reynolds number fluid-structure interaction scales linearly with the ratio of fluid viscosity to solid Young's modulus. For sufficiently large values of Young's modulus, both time- and length-scales of the viscous-elastic dynamics may be similar to acoustic time- and length-scales. However, the requirement of dominant viscous effects limits the validity of such regimes to micro-configurations. We here study the dynamics of an acoustic plane wave impinging on the surface of a layered sphere, immersed within an inviscid fluid, and composed of an inner elastic sphere, a creeping fluid layer and an external elastic shell. We focus on configurations with similar viscous-elastic and acoustic time- and length-scales, where the viscous-elastic speed of interaction between the creeping layer and the elastic regions is similar to the speed of sound. By expanding the linearized spherical Reynolds equation into the relevant spectral series solution for the hyperbolic elastic regions, a global stiffness matrix of the layered elastic sphere was obtained. This work relates viscous-elastic dynamics to acoustic scattering and may pave the way to the design of novel meta-materials with unique acoustic properties.

[1]ISF 818/13

Amir Gat
Technion - Israel Institute of Technology

Date submitted: 22 Jul 2017 Electronic form version 1.4