Contribution ID: **17** Type: **not specified**

Acoustic Cavitation using Resonating Micro-Bubbles. Analysis in the Time-Domain

Thursday, 6 July 2023 11:00 (25 minutes)

We study the time-domain acoustic wave propagation in the presence of a micro-bubble. This micro-bubble is characterized by a mass density and bulk modulus which are both very small as compared to the ones of the uniform and homogeneous background medium. The goal is to estimate the amount of pressure that is created very near (at a distance proportional to the radius of the bubble) to the bubble. We show that, at that small distance, the dominating field is reminiscent to the wave created by a point-like obstacle modeled formally by a Dirac-like heterogeneity with support at the location of the bubble and the contrast between the bubble and background material as the scattering coefficient. As a conclusion, we can tune the bubbles material properties so that the pressure near it reaches a desired amount. Such design might be useful in the purpose of acoustic cavitation where one needs enough, but not too much, pressure to eliminate unwanted anomalies. The mathematical analysis is done using time-domain integral equations and asymptotic analysis techniques. A well known feature here is that the contrasting scales between the bubble and the background generate resonances (mainly the Minnaert one) in the time-harmonic regime. Such critical scales, and the generated resonances, are also reflected in the time-domain estimation of the acoustic wave. In particular, reaching the desired amount of pressure near the location of the bubble is possible only with such resonating bubbles.

Key Words. Time-Domain Acoustic Scattering, Contrasting Media, Bubbles, Asymptotic Analysis, Retarded Layer and Volume Potentials, Lippmann–Schwinger equation.

Primary author: MUKHERJEE, Arpan (Johann Radon Institute (RICAM), Austrian Academy of Sciences)

Co-author: Prof. SINI, Mourad (Johann Radon Institute (RICAM), Austrian Academy of Sciences)

Presenter: MUKHERJEE, Arpan (Johann Radon Institute (RICAM), Austrian Academy of Sciences)