



New Progress in Bubble Dynamics theory

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چکیده:

A novel theory for the dynamics of oscillating bubbles such as cavitation bubbles and air bubbles was established by Prof Zhang and his Team. For the first time, they proposed bubble dynamics equations that can simultaneously take into consideration the effects of boundaries, bubble interaction, ambient flow field, gravity, bubble migration, fluid compressibility, viscosity, and surface tension while maintaining a unified and elegant mathematical form. The present theory unifies different classical bubble equations such as the Rayleigh–Plesset equation, the Gilmore equation, and the Keller–Miksis equation. Furthermore, we validated the theory with experimental data of bubbles with a variety in scales, sources, boundaries, and ambient conditions and showed the advantages of their theory over the classical theoretical models, followed by a discussion on the applicability of the present theory based on a comparison to simulation results with different numerical methods. Finally, as a demonstration of the potential of our theory, they modeled the complex multi-cycle bubble interaction with wide ranges of energy and phase differences and gained new physical insight into inter-bubble energy transfer and coupling of bubble-induced pressure waves.

بیوگرافی:

A-Man Zhang is a National Level Distinguished Professor at Harbin Engineering University. His main research fields include bubble dynamics and fluid-structure interaction. He has undertaken more than 40 scientific research projects, including the National Key Research and Development Program and National Natural Science Foundation Projects. He established a new equation for bubble dynamics, constructed fully coupled gas-liquid-solid dynamic models and methods, led the development of the FSLAB fundamental industrial software for fluid-structure interaction and the construction of a series of experimental new methods and techniques for bubble dynamics, and the research achievements have been widely applied. Academic papers are published on renowned journals including Journal of Fluid Mechanics and Journal of Computational Physics, with more than 15,000 citations. Received multiple awards such as the National Innovation Competition Award, Ho Leung Ho Lee Innovation Award, the Xplore Prize, Second Prize of the National Technology Invention Award, Second Prize of the National Science and Technology Progress Award, Highly Ranked Scholar. Served as editor in chief of Journal of Marine Science and Application, and editorial board member of multiple academic journals including Applied Ocean Research and Journal of Hydrodynamics, among others.



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