Numerical Simulation of Nonlinear Acoustic Waves in Two-Phase Fluid

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Nonlinear acoustic wave propagation equation with void fraction (volume fraction of gas phase) is derived and numerically solved for the simulation of HIFU (High Intensity Focused Ultrasound) with micorbubbles in the present paper. HIFU is one of promising treatments for cancer. The focused pressure waves generate heat and necrose cancer cells. It has been lately reported that the existence of micorbubbles enhances heating at the focal area and the present paper is intended to clarify this mechanism with numerical approach. After describing the derivation of the governing equations and the detail of the numerical method, computed results with varying initial void fractions and bubble sizes are presented to show the propagation of ultrasound and the bubble motions in the focal area. Additionally heat generation by microbubbles are also simulated and evaluated.

Keywords: Ultrasound, Bubble, CFD, Multiphase, HIFU (High Intensity Focused Ultrasound)