Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Two Types of Equations for Nonlinear Wave Propagation in a Liquid Containing Microbubbles TETSUYA KANAGAWA, Division of Mechanical and Space Engineering, Hokkaido University, TAKERU YANO, Department of Mechanical Engineering, Osaka University, MASAO WATANABE, SHIGEO FUJIKAWA, Division of Mechanical and Space Engineering, Hokkaido University — Weakly nonlinear propagation of one-dimensional dispersive waves in mixtures of a liquid and a number of spherical gas bubbles are theoretically investigated based on two-fluid averaged equations derived by the present authors. A set of equations consists of the conservation laws of mass and momentum for gas and liquid phases, and Keller's bubble dynamics equation. The compressibility of liquid leads to the wave attenuation due to bubble oscillations. By using the appropriate scaling of physical parameters and the method of multiple scales, two types of equations for nonlinear wave propagation in long ranges are derived. In a moderately low frequency band, the behavior of weakly nonlinear waves is governed by the KdV-Burgers equation. On the other hand, in a moderately high frequency band, the nonlinear modulation of quasi-monochromatic wave train is governed by the nonlinear Schroedinger equation with an attenuation term.

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Date submitted: 06 Aug 2009 Electronic form version 1.4