Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Measurement and Modeling of Channel Wall Vibration Subjected to Internal Bubbly Flow[1] MINGMING ZHANG, JOSEPH KATZ, ANDREA PROSPERETTI, Johns Hopkins University — The effect of a bubbly flow, injected into both a square and rectangle channels, on channel wall vibrations is studied experimentally and theoretically. The vibrations are measured under various gas void fractions, bubble diameters and channel dimensions. A theoretical model, based on a waveguide theory and bubble dynamics, is developed to predict the dominant frequencies in vibration spectra, the corresponding decay rates and propagation phase speeds. Results show that, compared with no bubble case, the presence of bubbles substantially enhances the power spectral density of vibrations, by up to 27 dB in a square channel and 37 dB in a rectangular channel. The origin of enhanced vibrations is attributed to the excitation of the streamwise propagating pressure waves, created by an initial acoustic energy generated during bubble formation. The model predicts very well the magnitudes and trends of the dominant spectral frequencies, the corresponding decay rates and phase speeds. The frequency, attenuation and phase speed decrease substantially with increasing void fraction but slightly with increasing diameter.

[1]Sponsored by ONR

Mingming Zhang
Johns Hopkins University

Date submitted: 06 Aug 2008

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