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Thesis Outline

Wave propagation across solid-fluid interface with fluid-structure interaction

Tomohisa Kojima

Fluid-structure interaction (FSI) problems are important for they could induce serious damage to structures. In some of the FSI problems, interaction mechanism strongly depends on wave propagation across the interface of solid and fluid. However, mechanics of wave propagation across the solid-fluid interface with structural motion has not been clarified yet. This thesis is to investigate wave propagation across a solid-fluid interface with fluid-structure interaction and explore a theoretical model for predicting the interfacial and transmitted pressure induced on the interface of FSI. Chapter 1 of the thesis gives background and motivation of the thesis.

In chapter 2, *Experimental method for simulating wave propagation across the interface of fluid-structure interaction*, the experimental system with cylindrical solid buffer and the water-filled tube was developed by modeling the FSI interface as a solid-fluid movable interface. Then, impact experiments were conducted to investigate wave propagation across the solid-fluid movable interface.

In chapter 3, *Wave propagation across solid-fluid movable interface in fluid-structure interaction*, a theoretical model for predicting the interfacial pressure was proposed based on the momentum conservation of the projectile, buffer, and water by assuming the projectile and buffer as rigids. The predicted value was well accord with averaged value of the measured interface pressure.

In chapter 4, *Two-dimensional analysis of wave propagation across the interface of fluid-structure interaction*, it was revealed by numerical analysis with a two-dimensional axial symmetric model, that the peak values of interfacial and transmitted pressures were radially distributed at the interface due to the tube expansion, resulting in the deviation of the peak pressure from the one-dimensional theory. From the numerical results, the transition region of transmitted peak pressure was located. Then, the proposal was made to estimate the peak pressure in the transition region in the sight of safety engineering.

In chapter 5, *Wave propagation across the interface of fluid-structure interaction with various surface conditions of solid medium*, experiments were conducted with changing the surface condition of the solid. It was found that if the surface wettability of solid is improved, wave transmission behavior is changed with inhibition of the cavitation generation.