Some Recent Developments in Scattering Problems in Fluid-Structure Interaction

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This lecture is concerned with the direct and inverse scattering problems in fluid-structure interaction. Scattering problems in the fluid-structure interaction can be simply described as follows: an acoustic wave propagates in the fluid domain of infinite extent where a bounded elastic body is immersed. The direct problem is to determine the scattered pressure and velocity fields in the fluid domain as well as the displacement fields or stress fields in the elastic body, while the inverse problem is to reconstruct the shape of the elastic scatterer from a knowledge of the far filed pattern of the fluid pressure or from the measured of scattered fluid pressure filed. As is well known, the inverse problems are generally nonlinear and highly ill-posed. For treating inverse problem of this kind, we reformulate the problem as a nonlinear optimization problem including special regularization terms. The precise formulation of the nonlinear objective functional will depend on the approaches of the direct problem. In this lecture we will present various approaches for the direct problem based on the formulations with or without introducing artificial boundaries and their corresponding formulations of the inverse problem. Emphasis will be placed upon the mathematical foundations of the variational formulations of the corresponding problems. Some numerical experiments will also be included.