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Modeling shell-shock interaction in a multi-fluid environment

A fluid-filled submerged cylindrical shell is considered for the most general case of contact with fluid, i.e., when the internal and external fluids are different. It is shown that the interaction in this case is very different from the case of two identical fluids. Specifically, it is demonstrated that the response of the system is much more complex in terms of the fluid-structure interaction effects, and that a wider variety of shock wave reflection phenomena is observed. The ratio of the acoustic speeds in the internal and external fluids is shown to be the single most important parameter determining the main features of the interaction. Depending on the value of the ratio, four qualitatively different regimes of interaction are shown to exist. Each regime has its unique dynamic features of which the most notable is the possibility of observing different reflection-focusing sequences for the pressure wave inside the shell. The practical relevance of the fluid-structure interaction effects observed is discussed.

This is a joint work with Garrett Dooley, Bryan MacDonald and Jonathan Gaudet.