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Cavitation in shock-subjected shell systems

Cavitation induced as a result of the interaction between shock waves and thin-walled structures submerged into and/or filled with fluid is an important factor that needs to be taken into account when the shock response of industrial systems is analyzed. When shock-induced cavitation takes place, it is known to dramatically change the dynamics of the process, often leading to a very significant increase in the overall loading experienced by the structure. Cavitation in general is a difficult phenomenon to model, and it becomes particularly challenging when coupled with the structural dynamics. In this presentation an approach based on a linear model of the interaction is used to predict the most probable regions where cavitation is expected to develop inside and outside the shell. It is demonstrated that, depending on the circumstances, several different cavitation scenarios can exist for the same system, especially when the internal fluid volumes are present. Each scenario has different consequences in terms of both the overall dynamics of the system and the potential damage to the structure.

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