Fluid-Structure Interaction of a Surface Effect Ship Bow Seal & a Free Surface

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A Surface Effect Ship (SES) has a pair of side hulls with flexible seals fore and aft which contain the cushion pressure provided by lift fans. Due to the highly flexible nature of these seals, they interact quite dynamically with the free surface.

A series of model tests were performed at the University of Michigan in order to aid the understanding of this interaction and these tests are being simulated in this presentation. This simulation employs the co-simulation engine coupling Abaqus with STAR-CCM+ first implemented in version 5.06. Early versions of this tool used explicit (loose) coupling between the codes which resulted in an inherently unstable solution. The improved implicit (tight) coupling algorithm implemented in version 7.04 stabilizes the simulation of the highly flexible seal response. Periodic remeshing of the STAR-CCM+ domain is necessary as the seal response exceeds the limits of the mesh morpher.

Current work simulates the bow seal interacting with the free surface at forward speed with a momentum source providing the cushion pressure. The initial results are promising and more work must be completed to better characterize the highly flexible rubberized fabric materials in Abaqus, as well as work on automating the remeshing process.

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