Spillage Prediction Using Fluid-Structure Interaction Simulation with Coupled Eulerian-Lagrangian Technique

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Abstract : The current product development process needs simultaneous consideration of different physics. The performance of the product needs to be considered under both structural and fluid loads. Examples include ducts and valves where structural behavior affects fluid motion and vice versa. Simulation of fluid-structure interaction involves modeling interaction between moving components and the fluid flow. In these scenarios, it is difficult to calculate the damping provided by fluid flow because of dynamic motions of components and the transient nature of the flow. Abaqus Explicit offers general capabilities for modeling fluid-structure interaction with the Coupled Eulerian-Lagrangian (CEL) method. The Coupled Eulerian-Lagrangian technique has been used to simulate fluid spillage through fuel valves during dynamic closure events. The technique to simulate pressure drops across Eulerian domains has been developed using stagnation pressure. Also, the fluid flow is calculated considering material flow through elements at the outlet section of the valves. The methodology has been verified on Eaton products and shows a good correlation with the test results.

Keywords : Coupled Eulerian-Lagrangian Technique, fluid structure interaction, spillage prediction, stagnation pressure

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