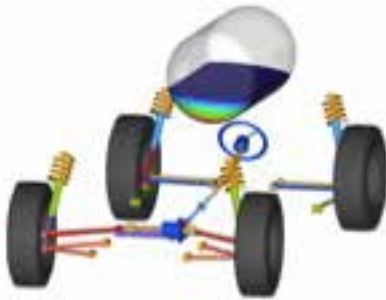


Tanker Truck Sloshing Simulation Using Bi-directionally Coupled CFD and Multi-Body Dynamics Solvers

Michael S. Barton, David Corson, Jon Quigley, Babak Emami, Tanuj Kush, *Altair Engineering, Inc.*



Tanker truck simulation

Abstract

In this work, the multi-disciplinary problem arising from fluid sloshing within a partially filled tanker truck undergoing lateral acceleration is investigated through the use of multiphysics coupling between a computational fluid dynamics (CFD) solver and a multi-body dynamics (MBD) solver. This application represents a challenging test case for simulation technology within the design of commercial vehicles and is intended to demonstrate a novel approach in the field of computer aided engineering.

Computer aided engineering is playing a more predominant role in the design process for commercial and passenger vehicles. Better understanding of the real time loading and responses on a vehicle during intended or unintended use can result in improved design and reduced cost over traditional designs that relied heavily on assumed loads. Liquid sloshing within the cargo tank of a commercial tanker truck results in increased loading on the vehicle's suspension when undergoing acceleration maneuvers. The change in loading can have a significant effect on the design of the vehicles suspension components and braking components. The ability to investigate the fully coupled behavior of the mechanical and fluid systems is a key technology to enable improved designs for these types of applications.

The following paper presents a multiphysics analysis of a simplified tanker truck undergoing a lane change maneuver. Bi-directionally coupled CFD and MBD solvers are used to compute the response of the vehicle during a lane change maneuver. The distribution of the liquid within the cargo tank is computed by the CFD solver, AcuSolve using an Arbitrary Lagrange-Eulerian (ALE) mesh motion approach. The forces resulting from the sloshing are then passed to the MBD solver, MotionSolve and the response of the tanker truck is computed. This exchange of forces and displacements occurs at run time and is enabled through a socket connection between the two solvers.

► For more details, visit <http://papers.sae.org/2014-01-2442/>