VALIDATION OF COUPLED FLUID-STRUCTURE SIMULATION AGAINST EXPERIMENTS IN THE LARGE BLAST SIMULATOR LBS 501

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The predictive simulation of blast effects on structures is required in a variety of applications e.g. the blast resistance of military vehicles and equipment. Besides the treatment of large and complex geometries a predictive simulation requires the simultaneous, coupled solution of the fluid- and structural dynamic equations. The coupling accounts for the interaction between loading and response, which is relevant if both have the same time scale. Furthermore it offers a precise and convenient transference of timely and spatially non-uniform surface pressures from the CFD- to the CSD-code.

For the simulation of the transient response of structures to blast loads, the inhouse developed codes APOLLO (CFD) and SOPHIA (CSD) are loosely coupled using the MPI environment. A series of experiments in the LBS 501 is dedicated to the validation of these methods. In these experiments, container-like structures with dimensions 2m x 1m x 1m supported on four legs were used as test objects. While in earlier tests the containers were supported on rigid legs, current tests will use flexible legs, which will permit to accurately measure the total momentum transfer via rigid body motions of the containers. For a detailed evaluation of the loading and the response the containers are instrumented with numerous pressure gauges and optical deformation sensors.

The paper provides an overview about the numerical concepts, methods and models, and presents a detailed comparison between computed and measured data. A specific aspect of the numerical model is the treatment of the blast wave generator system, which consists of up to 100 air-filled pressure reservoirs (pressure bottles) in the LBS. The discussion of results will include deformations and rigid body motions of the containers and also the pressure build-up inside the containers.

Literature:

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