

# K2DM – LIL Experiment Outline

## ADVENTURE

### A method for analytical and simulative calculation of a valve under acceleration loadings

#### THE CHALLENGE

High accelerations, such as those that occur in the event of a crash, can lead to high unwanted forces in overpressure safety valves, which in turn can result in unplanned opening procedures. Valves must be designed such that those undesirable openings are prevented at defined acceleration loadings.

#### SOLUTIONS AND METHODOLOGY

In ADVENTURE, a method for analytical and numerical calculation of the behavior of safety overpressure valves under high acceleration loadings is developed and applied.

A model in the finite element solver LS-DYNA (Figure 1) is created. Its simulation results are compared with analytically generated results. On the one hand, this allows the safety factor against opening to be determined for known acceleration pulses. On the other hand, it makes it possible to

determine the maximum allowed acceleration for avoidance of an undesired opening.

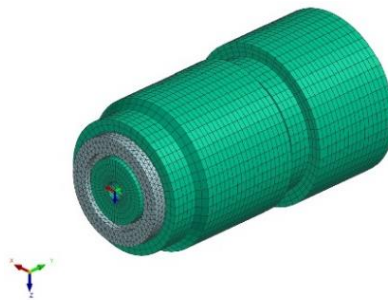


Figure 1: Modell of the valve under study

#### RESULTS AND IMPACT

With this method, it is possible to determine the safety margin and the maximum acceleration that can be achieved without unintentional opening.

In each case one calculation provides the verification for the other one. For example, the validity of the finite element simulation can be confirmed through analytical calculation. Results of the method for the

valve under study are shown in Figure 2.

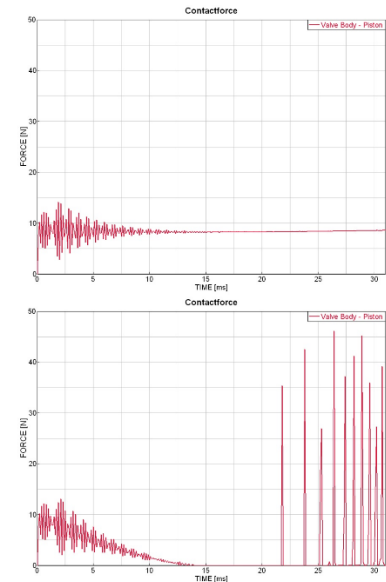


Figure 2: Nearly constant sealing force at given acceleration value (top) and loose of sealing force at slight acceleration overload (bottom)

In the future with this method, it will be possible to implement this aspect of product development purely virtually and thus without physical testing, thus saving costs and development time.

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Virtual Vehicle Research GmbH