F2010-C-055

MBS QUARTER VEHICLE TEST RIG– INFLUENCE OF DAMPER MODELLING ON SIMULATION QUALITY

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KEYWORDS – MBS simulation, quarter vehicle test rig, damper, shock absorber, simulation quality

ABSTRACT – This article shows the influence of the damper model quality on the overall simulation quality of a multi-body quarter vehicle test rig.

For the reduction of costs and development time in testing, the Institute of Automotive Engineering (IAE) has developed a hydraulic quarter vehicle test rig consisting of a vertically guided body mass, the chassis kinematics and the wheel. Advantage of the test rig in the analysis of prototypes is the reduction of needed components and the focus on the vertical dynamics.

Parallel to the hardware test rig, a multibody system model (MBS model) has been created that completes the development chain from the first simple model for approximate calculations to full vehicle prototypes and allows the detailed analysis of the influence of individual components on the quarter vehicle dynamics.

The quarter vehicle model is built as a universal test rig in ADAMS/Car that allows the simulation of different chassis models. Moreover, co-simulations with MATLAB/Simulink are included to use external chassis components, like a damper model presented in this paper. The potential improvement of the overall simulation is illustrated by an analysis of the damper model's impact.

Simulation results that are computed with the simple but still often used damper's characteristic line are compared to results computed with a nonlinear damper model consisting of a damper force characteristic map considering the inputs velocity and acceleration as well as spring stiffness.

The simulation results show the influence of the damper modelling on the dynamics of the MBS quarter vehicle test rig simulation. A significant improvement of the illustration of the overall dynamics can be achieved by using the presented damper model. The detailed modelling of other suspension components like frequency dependent bushings and the consideration of the stiffness of bodies being regarded as stiff so far lead to further enhancements in the simulation quality and finally enable a reduction of required test rig and development time by front loaded parameter optimisation.