FMI implementation in LMS Virtual.Lab Motion and application to a vehicle dynamics case

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The aim of this paper is to present the implementation of the Modelisar Functional Mock-up Interface (FMI) [1] in LMS Virtual.Lab Motion, a multi-purpose simulation software for mechanical systems [2]. LMS Virtual.Lab Motion is used as a simulation platform into which one or several FMUs can be linked in order to perform co-simulation for analyzing complex multidisciplinary systems. In co-simulation, the overall system is split into different subsystems, which are treated by different optimized simulation tools, coupled by input and output variables, thus creating a coupling loop [3]. For the two distinct standards, FMI for Model Exchange and FMI for Co-Simulation, the different approaches are described in detail in the paper.

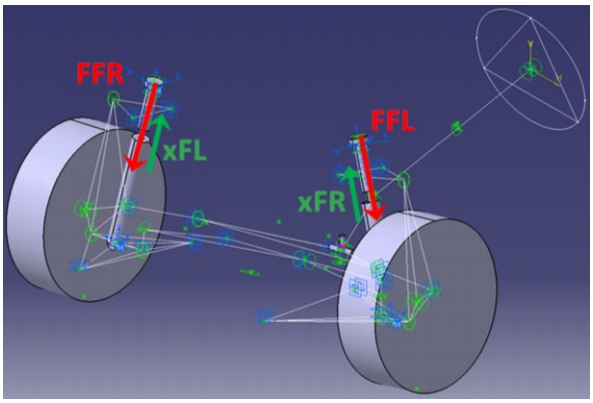

Figure 1: Vehicle front suspension model in LMS Virtual.Lab Motion (air-spring FMU inputs are highlighted in green and outputs in red)

For demonstrating the implementation of the FMI interface and industrial applicability, an application case is presented from automotive industry, with an Opposite Wheel Travel scenario using a half vehicle model in LMS Virtual.Lab Motion (as presented in Figure 1) and an Air-spring FMU based on Modelica code. For simplicity, the air-spring is modeled with an isothermal process, considering a closed system and ideal gas. The chamber of the gas is considered as rigid, thus neglecting the elasticity of the bellow. The Modelica model of the air-spring and obtained results are presented in detail in the paper.

References

[1] Functional Mock-up Interface: http://www.functional-mockup-interface.org/

[2] LMS International, LMS Virtual.Lab Rev. 11, http://www.lmsintl.com/virtuallab, May 2011.

[3] Busch M. and Schweizer B. Numerical Stability and Accuracy of Different Co-Simulation Techniques: Analytical Investigations Based on a 2-DOF Test Model, 1st Joint International Conference on Multibody System Dynamics, Lappeenranta, Finland, May 25–27, 2010.