Integration and Analysis of EPAS and Chassis System in FMI-based co-simulation

Weitao Chen[1,2] Shenhai Ran[1] Bengt Jacobson[2]

[1]Vehicle Dynamics CAE, Volvo Cars, Sweden,
{weitao.chen,shenhai.ran}@volvocars.com
[2]Vehicle Dynamics, VEAS, Chalmers University of Technology, Sweden,
bengt.jacobson@chalmers.se

Abstract

The vehicle steering characteristics and active functions can be virtually developed with a high-fidelity electric power assisted steering (EPAS) model and a multi-body chassis model. The simulation of the EPAS model requires small integration step due to high stiffness and interfacing with the controller. The multi-body chassis model is computationally heavy for each integration step due to calculation of large matrices. A mono-simulation based on a single solver is not efficient for this case. Instead a co-simulation (solver coupling) approach has been used to overcome the drawbacks.

In this paper we model the EPAS system and chassis system in Dymola. The models are exported as separate functional mockup units (FMU)s and integrated with the control algorithms in Matlab. A co-simulation based on the explicit parallel calculation scheme (Jacobi scheme) has been used. A huge simulation speed-up has shown the potential and effectiveness of the approach. To understand its accuracy and tolerance, analysis on the numerical error and system dynamics are given.
Keywords: EPAS system, Chassis system, Co-simulation, FMU