Different Models of a Scaled Experimental Running Gear for the DLR RailwayDynamics Library

Christoph Schwarz Andreas Heckmann Alexander Keck

Institute of System Dynamics and Control, German Aerospace Center (DLR), 82234 Wessling, {Christoph.Schwarz, Andreas.Heckmann, Alexander.Keck}@dlr.de

The DLR internal project "Next Generation Train" (NGT) deals with a high-speed train in a double-deck configuration. To realize the two continuous floors, a single wheel running gear configuration is selected. Equipped with independently rotating wheels instead of a usual wheel-set, a track guidance control becomes necessary. In terms of an advanced control and observer development the implementation of validated simulation models is absolutely essential.

Therefore, the paper gives a short overview of the hardware of the scaled Experimental Running Gear on the DLR roller rig representing the NGT single wheel running gear. Using the DLR RailwayDynamics Library three different models of the running gear are implemented. The first model is a detailed multibody model, whose frequency response is validated with respect to the running gear hardware using Closed-Loop-Identification (Saupe and Knoblach, 2012). Furthermore, a nonlinear analytical model is implemented, that can be used for example to develope a feed-forward control (Heckmann et al., 2015). The third model generated by linearizing the nonlinear analytical model allows for a stability analysis of the running gear configuration. Finally, some simulation results are presented, that point out the conformity of the particular simulation models, see Figure 1.

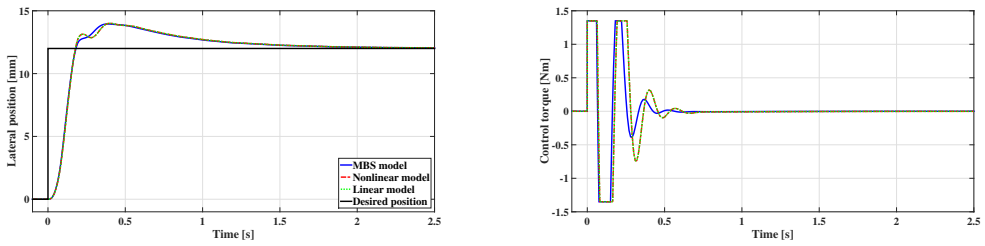

Figure 1. Lateral displacement and control torque of the three presented simulation models at $v_R = 6\ \frac{\mathrm{m}}{\mathrm{s}}$.

References

A. Heckmann, C. Schwarz, T. Bünte, A. Keck, and J. Brembeck: Control development for the scaled experimental railway running gear of DLR, *Vehicle System Dynamics*, 2015, to appear.

F. Saupe, A. Knoblach, Design of excitation signals for the closed loop identification of industrial robots, *In: IEEE International Conference on Control Applications*, 2012.