Modeling of an Automatic Transmission for the Evaluation of Test Procedures in a Virtual End-of-Line Test Bench

Jan Röper[1] Jörn Göres[1] Clemens Gühmann[2]

[1]Daimler AG, Germany {jan.roeper,joern.goeres}@daimler.com
[2]Chair of Electronic Measurement and Diagnostic Technology, Technische Universität Berlin, Germany clemens.guehmann@tu-berlin.de

End-of-line tests for automatic transmissions are mandatory to ensure quality and safety. The interaction of unit under test, test bench and test automation leads to a high complexity in the development of test automation and test procedures. Validation of test automation and test procedures requires access to the test bench and the unit under test, both of which are only available close to startup of production. Therefore, virtualization of test bench and unit under test can be used to ease the bottleneck.

Virtualization is a common tool in the development of electronic control units for automotive applications using SIL and HIL technologies. The properties of simulation models for a virtual end-of-line test bench differ from those for classical SIL and HIL environments. In this paper, an automatic transmission model suitable for a virtual end-of-line test bench is presented. The characteristics of an extended *kpki friction model* based on the implementation of (Bai et al., 2013) are discussed in detail. Hydraulics are modeled using a Moore machine to enable simulation of the pressure build-up characteristics during shift operation.

With the resulting model, the influence of the key parameter of a test procedure actuating an overlapping gearshift is investigated in a virtual test system. Figure 1 shows the simulation results of the parameter study with varied sleep time between clutch actuation. The characteristics of the variable clutch pressure p, rotational speed ω and shaft torque T are discussed in detail.

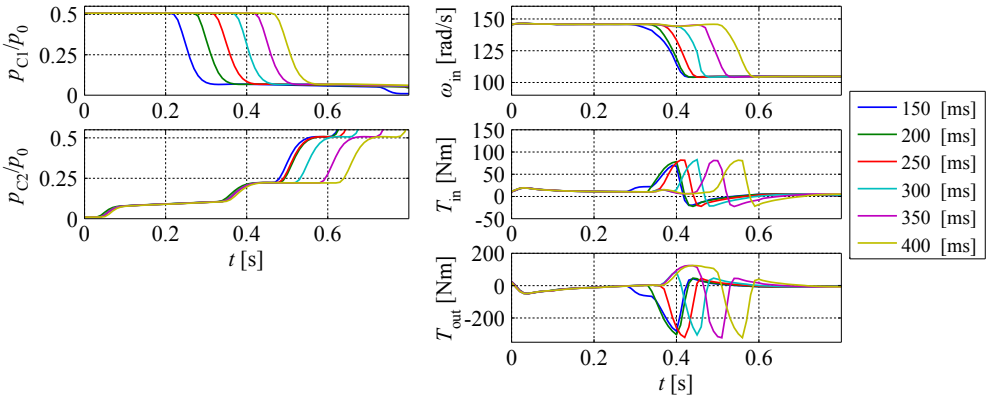

Figure 1. Simulation results of hydraulic pressure, rotational speed and torque

References

S. Bai, J. Maguire, and H. Peng. *Dynamic Analysis and Control System Design of Automatic Transmissions*. SAE International, 2013.