Scalable Model-based Gearbox Closed-Loop Control (GECCO)

K2-Project at Virtual Vehicle Research Center
Partner: AVL (industrial partner), IRT (scientific partner)
Duration: 01.01.2016 to 31.12.2018 (project extension)

The automotive industry faces a significant increase of vehicle and drivetrain variants, as recently, in addition to conventional vehicles, different stages of electrification open a new dimension to vehicle and drivetrain variants. Especially hybrid-electric concepts increase drivetrain configuration complexity and require highly sophisticated hybrid and transmission control strategies. Besides full integration of all electric components into the transmission, the integrated view as well as the electronic control of the overall vehicle plays a major role in the optimization of energy efficiency and emission behavior. Furthermore, advanced development tools and methodologies are required to reduce development time and costs while improving quality. Therefore, frontloading processes have received significant attention recently. Frontloading terms transferring development tasks to earlier stages in the development process like vehicle testing to 'in-the-Loop' (XiL) component testing, i.e. closed-loop simulation or testing. An efficient development process supports function development, function parametrization and variant acceptance testing via simulation models. Appropriate and validated real-time simulation models form the basis for a consistent development process from offline simulation and online testing to embedded control. In detail, this project targets for a generic real-time model description of automotive drivetrain topologies containing multiple interconnected clutches with an accuracy that enables representative evaluation of longitudinal driving comfort in transient vehicle operation, i.e. including vehicle launching and gear shifting. An additional aim is state and disturbance estimation for embedded control on the basis of this drivetrain model. Moreover, this project shall provide a profound basis for embedded model-based gear-shift control including the development of a generic gear-shift control strategy. Within the extension of the project the developed methods and approaches for modelling, simulation and online state-estimation are taken as a basis for novel model-based control approaches. To enable the control approaches new methods are developed extending the existing modelling approach for in depth analytics on possible gear-shifting strategies.