Multi-fidelity surrogate modelling of multispeed transmissions for fast and accurate e-powertrain design and control optimization

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**Background:**
The joint design and control optimization issue of electric powertrains is a highly complex one, which we typically try to solve using mathematical models. On the one hand, we want to have accurate models of the components, but this comes at the price of a higher computational cost. On the other hand, convex models are more easily scalable, but have higher modeling errors. Surrogate models, which predict the influence of the design on the behavior of a system based on a small number of samples in the design space, have the potential of combining the best of those two worlds.

**Project description:**
The student will explore the capabilities of (multi-fidelity) surrogate modeling of multispeed transmissions in the co-design of electric vehicle powertrain systems. The relevant design variables need to be identified, for instance by screening methods. Then, a suitable experiment plan must be designed and executed to learn as much as possible about the main effects and interactions of the transmission. Finally, an appropriate model function must be fitted to the data, which can be employed in an optimization algorithm for the full electric powertrain.

**Prerequisites:**
Control theory. Knowledge in Optimization and (Hybrid) Electric Vehicles is a plus, but not mandatory. Analytical and programming skills, initiative and independence.