

Using an Engine-in-the-Loop test bench for model based optimization of hybrid power trains

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Increasing oil prices, limited fossil resources and growing environmental requirements are a huge challenge in a world of growing demand for individual mobility. The aim of reducing the consumption of fossil energy sources and the production of greenhouse gas emissions demands alternative, innovative and effective powertrain solutions. Beside the optimization of internal combustion engines the combination with an electric motor in a hybrid electric vehicle (HEV) is a possibility to reach these targets.

Between conventional and electric vehicles almost all possible interim solutions of combinations of combustion engines, electric motors and batteries in hybrid structure as well as degree of hybridization are possible. For finding the optimal combination in this parameter space an intelligent engineering method is obligatory. Because of the wide range of solutions a strategic method must be used to handle the almost unmanageable task to find an optimal HEV configuration in minimal development time.

At the Institute of Internal Combustion Engines (ivb) a modular vehicle simulation model has been developed. By coupling the real-time vehicle model and a Hardware-in-the-Loop test bench engine parameters like fuel consumption and emissions can be analysed. The use of Engine-in-the-Loop provides the opportunity to integrate hard to simulate parameters in hybrid strategies.

In the presented paper the co-simulation method of Engine-in-the-Loop and vehicle model is introduced which enables the development of any kind of hybrid power-train. This tool covers the different hybrid structures and helps to design intelligent and unconventional hybrid strategies online. Some innovative strategies and the combination with thermal management will be presented.