Optimization with FMI and CasADi: Analysis in Industrial Applications

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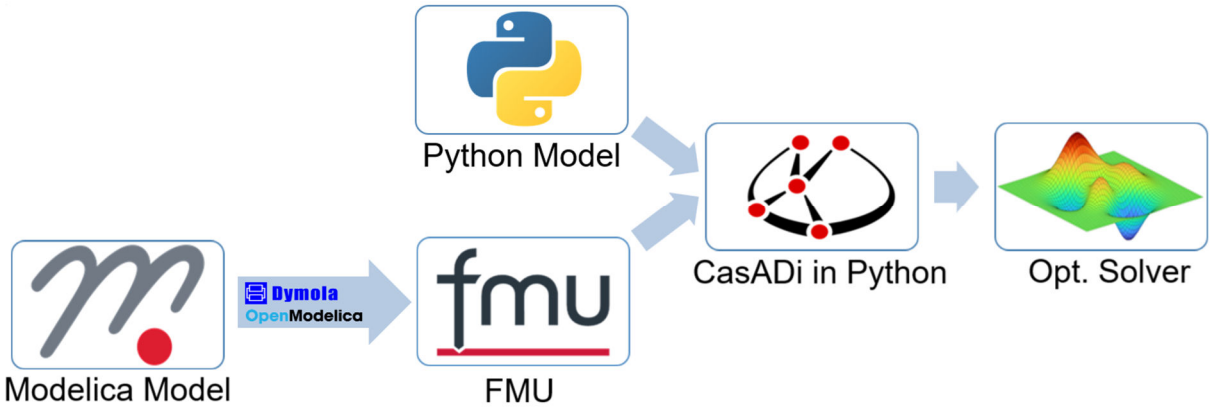
Abstract:

Motivated by real use cases from Bosch for optimization-based functions and controllers in the context of energy optimal operation of vehicles and buildings, we investigate the usage of FMI for optimization purposes via the open-source tool CasADi. We implemented a framework in Python to automatically compare optimization results and computation times of optimal control problems in CasADi:



We are able to compare the results generated by different implementations:

a) including the system dynamics as FMUs and
b) a native implementation where the system dynamics is realized by Python code for CasADi.

We present results from two use cases: the trajectory following of a single track vehicle model and the optimal control of a building's chiller system. Detailed analysis of the split of the execution time of one optimization run gives valuable insight which kind of FMI function calls or derivatives are competitive and which one have bottlenecks compared to the native solution in CasADi without FMUs.