An Asymptotic Solution Approach for Real Time Simulation of Aftertreatment Reactors in HiL Environments
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Motivation
- Model-based control of AT reactors
- Account for porous diffusion phenomenon
- Reduce control algorithm development time
- Reduce number of physical sensors used in a vehicle

Objective
Assess the validity of asymptotic solution for wide range of operating conditions in variety of AT reactors. Quantify the computational advantage of asymptotic solution by simulating various emission test cycles. Verify the Real Time capability of AT reactor models on HiL systems.

Detailed Model

Asymptotic Solution
- 1+1D model is most widely used for research and design purpose
- System of stiff differential-algebraic equations
- ODE solvers based on BDF methods are predominantly used
- Can be solved in real time on a typical PC but not on HiL systems with a small fixed time step (~ 100 ms)

Comparisons

HiL Simulations

Summary
Asymptotic solution is found to be up to two orders of magnitude faster than the 1+1D model while maintaining similar level of accuracy. The Real Time capability of the asymptotic solution is verified by HiL simulations.