Practical Application Of 1D Kinetic Modeling To Accelerate Exhaust Aftertreatment System Integration, Algorithm Development, And Calibration Tasks

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In the transportation industry, engine exhaust aftertreatment systems present development engineers with unique challenges. Due to the complicated multidimensional nature of aftertreatment devices, traditional iterative engineering methods can be inefficient and produce less than optimum results. The utilization of highly refined aftertreatment models by development engineers can significantly reduce the time and effort required to produce the best results. However, in order for these models to be incorporated into and engineer's daily activities, they must be simple to implement, fast to execute, accurate, and compatible with industry standard development tools.

Developing and testing an aftertreatment control algorithm in an engine test cell can be a costly endeavor, especially when physical processes such as DPF soot loading or NH3 adsorption on an SCR catalyst can take hours to complete for each iteration. To reduce the amount of engine testing required, the aftertreatment system is simulated using a 1D kinetic model. The kinetic model is calibrated using engine test data and the physical properties of the aftertreatment components. The calibrated model then becomes a "virtual test cell" allowing rapid software development (design of experiment iterations) reducing test-cell iteration testing. This presentation reviews the practical application of a 1D aftertreatment system model to speed up algorithm development and improve calibration quality.

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