# Plenary Lecture

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## Title: Actuator and state constraints in automotive engines and powertrain systems: what do we do about them?

## Abstract

With the continuing trends towards growing complexity, downsizing and improved performance, constraint handling and limit protection functions are becoming increasingly important to enable automotive engines and powertrain systems to operate safely at the "limits". Constraints reflect actuator range and rate limits as well as safety requirements (e.g., speed, torque, pressures, temperatures, flows, etc. should not exceed safe values).

The presentation will give examples of constraints in engines and powertrain systems, and discuss approaches for handling them through control. Specific emphasis will be on opportunities to systematically implement constraint handling/limit protection capabilities through model predictive control and add-on schemes such as reference governors.

Examples of control with constraint handling in gasoline turbocharged direct injection engines and in diesel engines will be given. Free piston engines will also be discussed for which it will be argued that constraint handling algorithms are an enabling technology. Model predictive control solutions for continuously variable transmissions, soft constraint handling in hybrid powertrain systems with small energy storage, and the rollover protection at a vehicle dynamics level will also be considered.

The talk will end with perspectives on challenges and opportunities in handling constraints in engine and powertrain control applications.