

## Linear Parameter-Varying Control for Selective Catalytic Reduction Systems

**Authors :** Jihoon Lim, Patrick Kirchen, Ryoza Nagamune

**Abstract :** This paper proposes a linear parameter-varying (LPV) controller capable of reducing nitrogen oxide (NO<sub>x</sub>) emissions with low ammonia (NH<sub>3</sub>) slip downstream of selective catalytic reduction (SCR) systems. SCR systems are widely adopted in diesel engines due to high NO<sub>x</sub> conversion efficiency. However, the nonlinearity of the SCR system and sensor uncertainty result in a challenging control problem. In order to overcome the control challenges, an LPV controller is proposed based on gain-scheduling parameters, that is, exhaust gas temperature and exhaust gas flow rate. Based on experimentally obtained data under the non-road transient driving cycle (NRTC), the simulations firstly show that the proposed controller yields high NO<sub>x</sub> conversion efficiency with a desired low NH<sub>3</sub> slip. The performance of the proposed LPV controller is then compared with other controllers, including a gain-scheduling PID controller and a sliding mode controller. Additionally, the robustness is also demonstrated using the uncertainties ranging from 10 to 30%. The results show that the proposed controller is robustly stable under uncertainties.

**Keywords :** diesel engine, gain-scheduling control, linear parameter-varying, selective catalytic reduction

**Conference Title :** ICET 2020 : International Conference on Engine Technologies

**Conference Location :** Venice, Italy

**Conference Dates :** November 12-13, 2020