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Robust Design of Velocity-adaptive Control for an All-wheel Steering Car

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Drivability of passenger cars may be improved by adding a proper rear steering strategy with velocity-adaptive control. This strategy is optimized in the frequency domain where the design objectives concern the response dynamics of lateral acceleration and yaw velocity. The design variables include both discrete variables for velocity independent parameters and shape functions for velocity-adaptive control parameters. The resulting bi-criterion optimization problem is solved with a multi-objective genetic algorithm.

Typically, such an optimization drives designs towards the borders of the feasible design space. However, in reality these designs cannot be manufactured as precisely as proposed or the system is exposed to changing environmental conditions. Then even small system changes will lead to infeasible or non-optimal system behavior. In order to account for such uncertainties, the objectives should be considered as random variables during the design phase already, and a robust design concept should be applied. Therefore, mean values are minimized to obtain best mean behavior, and variances are minimized to achieve best robustness against change of car parameters. The presentation will demonstrate the transition from the deterministic to the robust design problem formulation, and strategies for efficient solution.

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