

Session 21 - Optimal control of ODE car-following models applications to mixed-autonomy platoon control via coupled autonomous vehicles.

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We study the optimal control of a mixed-autonomy vehicle platoon on a single-lane road, aiming to smooth traffic flow. The platoon includes autonomous vehicles, whose accelerations are controlled, and human-driven vehicles, modeled via a microscopic car-following law. The system dynamics are described by nonlinear ODEs with constraints on state and control variables. We analyze well-posedness and prove the existence of optimal solutions. A gradient-based algorithm using the adjoint method, combined with a penalty approach for state constraints, is proposed for numerical optimization. Simulations demonstrate the method's effectiveness under varying levels and distributions of autonomy.

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