Velocity Tracking for Autonomous Railway-based Pods by Contraction

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Résumé

Velocity tracking (path control) is fundamental for ensuring both service quality and safety in autonomous railway-based transportation systems. However, guaranteeing stability and robustness to disturbances in tracking performance remains challenging. In this work, we present the dynamical model of a railway-based transportation pod and unveil the presence of a two-time scale separation within its dynamics. Then, we design an output-feedback controller based on the reduced model to enforce contraction in the closed-loop system. We derive explicit contraction bounds showing that the velocity trajectories of the full closed-loop pod system as well as its reduced model converge towards each other within quantifiable limits. A numerical illustration is provided to demonstrate the relevance of the proposed approach.

Mots-Clés: Autonomous vehicles, Tracking control, Nonlinear control systems, Output feedback control, Robustness and disturbance rejection

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