Local Controllability of Underactuated Systems Subject to Unilateral Input Constraints

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Résumé

This work investigates the small-time local controllability (STLC) of nonlinear underactuated systems where control inputs are restricted to be non-negative, a fundamental feature of many systems whose actuators can only generate forces in one direction. Unilateral constraints break the time-reversibility assumption of classical STLC theory: trajectories cannot, in general, be reversed by negating the inputs. We discuss a geometric viewpoint that characterizes feasible velocities and restricted reachable directions near a configuration, and we indicate how Lie-bracket–based conditions must be reconsidered when the control set is asymmetric. The study is part of an ongoing PhD project motivated by suspended cable-driven parallel robots, for which a nonlinear dynamic model has been derived and is currently under investigation. This talk will present the main theoretical challenges, the first insights obtained so far, and the open questions that guide the continuation of this work.

Mots-Clés: Nonlinear underactuated systems, Geometric control theory, Asymmetric control sets.

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