Commande en coordination de systèmes multi-agents robotiques autonomes sous contraintes

Soutenance de thèse – Esteban Restrepo

Le 30/11/2021 à 15h00

Lieu : Visio à Paris-Saclay, https://teams.microsoft.com/l/meetup-join/19:tBhFLPrZU3Zi_rOBsEJm9I-R6EZ_K7Q6Nlp2Rr3q3e01@thread.tacv2/1637065476063?context=%7B%22Tid%22:%2261f3e3b8-9b52-433a-a4eb-c67334ce54d5%22,%22Oid%22:%229c1f3c8d-499d-414c-98a6-26edf08579

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Abstract :

In this thesis we address and solve several concrete problems of control of multi-agent systems under multiple inter-agent constraints. Some of our contributions address problems of consensus for linear systems (primarily integrators of any order) and others solve concrete relevant problems involving nonlinear models, such as nonholonomic vehicles or thrust-propelled underactuated unmanned autonomous vehicles, and considering nonlinear interconnections. Thus, the control problems that we address and their formulation stem from the realm of robotics and more particularly, of control of cooperative autonomous vehicles, both terrestrial and aerial.

Concerning first- and second-order integrators, the originality of this work consists in developing a new stability analysis for multi-agent systems under the action of consensus control algorithms and with proximity constraints and disturbances. Using an edge-based representation of the multi-agent system we establish strong stability and robustness properties, in the sense of asymptotic and input-to-state stability, via the construction of strict Lyapunov functions. Then, we consider generalize these results in two directions. First, we develop a control methodology that solves the consensus problem for multi-agent systems of high-order systems under nonlinear interconnections and disturbances. On the other hand, we consider robotic systems modeled by nonlinear dynamic equations and subject to multiple inter-agent constraints and disturbances. In both cases we establish stability and robustness of the closed-loop systems using arguments from control systems' theory on cascaded interconnections, singular perturbations, and multi-stability.

Keywords

Strict Lyapunov functions, multi-agent systems, consensus, autonomous vehicles, edge-agreement, inter-agent constraints