PhD Defense

Tuesday, 3 December 2024 at 14:00 in A042

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Vincent MARGUET will defend his thesis titled

Motion planning for multi-agent dynamical systems in a B-spline framework

in front of the jury members

Pr. Pedro Aguiar	Univ. of Porto, Portugal	Reviewer
Pr. Sihem Tebbani	CentraleSupélec, France	Reviewer
Dr. Julian Barreiro Gomez	Khalifa Univ. Abu Dhabi, UAE	Examiner
Pr. Santosh Devasia	Univ. of Washington, USA	Examiner
Pr. Jean-Paul Jamont	LCIS, UGA, France	Examiner
DR. CNRS Nicolas Marchand	Gipsa-lab, Grenoble INP, France	Examiner
Pr. Florin Stoican	UPB, Bucharest, Romania	Examiner
Dr. Ionela Prodan	LCIS, Grenoble INP - UGA	Director

Abstract: Generating offline feasible trajectories is paramount in motion planning applications to ensure safe, efficient, and reliable system performance during online execution. At the offline stage, the focus is primarily on optimizing the trajectory without concern for computational complexity, while at the online stage, both optimality and computational efficiency are equally important.

For the specific case of Unmanned Aerial Vehicles (UAVs), these trajectories must not only comply with internal dynamics but also adapt to environmental constraints. By precomputing optimal paths, UAVs can ensure energy-efficient navigation, avoid collisions, and maintain communication with other agents in real-time operations.

This thesis investigates methods for generating such offline trajectories, emphasizing their adaptability and feasibility for multi-agent aerial systems. Additionally, it addresses online distributed architectures to ensure reliable transitions between different configurations of multi-agent systems.

The motion planning problems explored in this thesis are addressed through a coherent integration of several techniques, including B-spline curves, optimization, evolutionary computation, and distributed control architectures. This comprehensive framework is applied both to the generation of offline trajectories and to the online motion planning of multi-agent dynamical systems.

The indoor experimental validations conducted with multiple nanodrones bridge the gap between theoretical developments and practical applications, demonstrating the feasibility and effectiveness of the proposed methods.

Keywords: Motion planning, Connectivity maintenance, Unmanned Aerial Vehicles (UAVs), B-splines with knot refinement, Schoenberg operator, Distributed Model Predictive Control (MPC), Population Games.