RÉPUBLIQUE FRANÇAISE
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PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DTIS-2026-28** *(à rappeler dans toute correspondance)*	Lieu : Palaiseau
Département/Dir./Serv. : DTIS	Tél. : 01 80 38 66 63
Responsable(s) du stage : H. Piet-Lahanier, S. Bouin	Email. : Helene.piet-lahanier at onera.fr

DESCRIPTION DU STAGE

Thématique(s) : ICS
RA

Type de stage : ☒ Fin d'études bac+5 ☐ Master 2 ☐ Bac+2 à bac+4 ☐ Autres

Intitulé : Coordinated Control of multiple clusters of autonomous vehicles

Sujet : Control of swarms of heterogeneous autonomous vehicles presents major difficulties because of its high level of complexity. The control must be designed in order to satisfy the limitations and constraints of the different types of vehicles while insuring some sort of coordination and cooperativeness. It has also to insure safety requirements in terms of potential collisions between the vehicles or with existing obstacles and account for uncertainties on the vehicle trajectories or the characteristics of the environment .

Organizing the fleet into clusters with similar potentialities has been suggested to address this problem [1, 2]. The clusters are selected as being of given geometric shape containing a number of vehicles, the trajectory of which is used to define the boundary of the state evolutions of the vehicles within. The swarm control is thus designed to coordinate the different clusters to realize some missions such as zone exploration or surveillance.

The subject of the proposed internship is to develop a coordinate control law based on the approach presented in [2] for ellipsoidal clusters as a generalization of the initial work of A. Kurzhanski [3]. The mission considered here is a distributed efficient exploration of a zone, requiring regular exchanges of information between the clusters. The focus will be set on the study of the robustness of the resulting design in partially known environment and its extension to account for evolution of the clusters of the fleet in terms of sizes and number of vehicles. Further developments include the introduction of distributed estimators.

[1] Dang, Z., Yu, Y., Dai, Z., Zhang, L., Su, A., You, Z., & Gao, H. (2022). Multi-cluster coordinated movement and dynamic reorganization. Computational Mathematics and Mathematical Physics, 62(11), 1955-1970.

[2] Dang, Z., Dai, Z., Yu, Y., Zhang, L., Su, A., You, Z., & Gao, H. (2022). Team Control Problem in Virtual Ellipsoid and Its Numerical Simulations. Mathematics, 10(12), 1970

[3] Kurzhanski, A. B. (2016). Problem of collision avoidance for a team motion with obstacles. Proceedings of the Steklov Institute of Mathematics, 293(Suppl 1), 120-136.

Est-il possible d'envisager un travail en binôme ? Non

Méthodes à mettre en oeuvre :

☐ Recherche théorique ☒ Travail de synthèse

☒ Recherche appliquée ☐ Travail de documentation

☐ Recherche expérimentale	☐ Participation à une réalisation
Possibilité de prolongation en thèse : Non	
Durée du stage : Minimum : 4 mois	Maximum : 6 mois
Période souhaitée : Mars-Août 2026	

PROFIL DU STAGIAIRE

Connaissances et niveau requis : Automatique, Traitement du Signal, Robotique, M2 ou 3eme année Ecole Ingénieur	Ecoles ou établissements souhaités : M2 ATSI ou robotique, Ecole Ingénieur spécialité Automatique Traitement du Signal