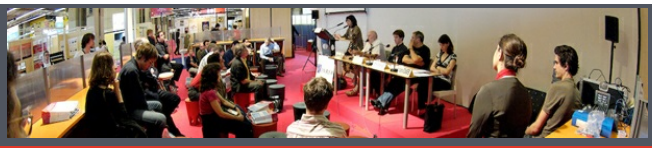
INVENTEURS DU MONDE NUMÉRIQUE

INTERNATIONAL RELATIONS



INTERNSHIP SUBJECT

2878 - Coordination of platoons with communication constraints

The property of string stability is essential for coordinating platoons of autonomous (or partly autonomous) vehicles. Indeed, string stability ensures that disturbances are dampened along the platoon, reducing their impact on the coordinate and smooth motion of the vehicles. In contrast, the lack of string stability may result in passenger discomfort, increased fuel consumption, or even safety risks [1].

Modern control algorithms in platooning employ Cooperative Adaptive Cruise Control (CACC) strategies to ensure string stability and a suitable platoon navigation. In CACC, vehicles share key information such as speeds, accelerations, and positions with other vehicles through wireless channels. Most of the literature on string stability considers that the communication channels are ideal or subject to deterministic delays. However, in practical implementations, the information shared among vehicles is limited by communication constraints and affected by any potential stochastic issues with the communication channel, such as stochastic delays, failures or noise.

Hence, algorithms able to cope with potential random issues are needed for the effective deployment of CACC into practice. This need has spurred the interest in studying platoons with stochastic phenomena, including platoons with communication links over additive noise channels [2], subject to random delays [3, 4], random data-loss [5,6,7] and even cyber attacks [8,9]. Additionally, deterministic notions of string stability have had to be extended to concepts that account for the stochastic nature of these phenomena [2,5].

Despite these initial advances, there are several open problems that remain within the context of platooning. Indeed, the principal researcher of the team in Chile is currently leading a research project dedicated to explore string stability in platooning affected by stochastic communication issues [10]. This project involves researchers from three institutions in Chile, as well as international collaborators, one of whom is the leader of the host team in France.

The internship would emphasize the study of string stability of platoons over fading channels for predecessor-following topologies, which is a less explored topic. Another emphasis will be the analysis of performance when the size of the platoon is large. Indeed, the scalability of control methods to large networks of interconnected dynamical systems is a core theoretical topic of the host Inria Team DANCE, whose main applications are in the fields of transportation and human mobility.

REFERENCES

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[2] Vargas, F. J., Gordon, M. A., Peters, A. A., & Maass, A. I. (2025). On stochastic string stability with applications to platooning over additive noise channels. Automatica, 171, 111923.

[3] Xu, L., Jin, X., Wang, Y., Liu, Y., Zhuang, W., & Yin, G. (2022). Stochastic stable control of vehicular platoon time-delay system subject to random switching topologies and disturbances. IEEE Transactions on Vehicular Technology, 71(6), 5755-5769.

[4] Zhao, F., Li, H., Wang, J., & Li, J. (2025). String Stability Based Cloud Predictive Control of Vehicle Platoon With Random Time Delay. IEEE Transactions on Vehicular Technology.

[5] Acciani, F., Frasca, P., Heijenk, G., & Stoorvogel, A. A. (2021). Stochastic string stability of vehicle platoons via cooperative adaptive cruise control with lossy communication. IEEE Transactions on Intelligent Transportation Systems, 23(8), 10912-10922.

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Required Skills

Being close to completing a university degree in Automatic Control, Electrical Engineering, or Applied mathematics.

Good command of English.

General Information

- **Research Theme :** Optimization and control of dynamic systems
- **Locality :** Saint Ismier
- **Level :** Master
- **Period :** 2nd January 2026 -> 30th March 2026 (3 months)

These are approximative dates. Please contact the training supervisor to know the precise period.

- **Deadline to apply :** 1st July 2025 (midnight)

Contacts

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- **Team Manager :** Paolo Frasca / paolo.frasca@inria.fr

More information

- **Inria Team :** DANCE
- **Inria Center :** Centre Inria de l'Université Grenoble Alpes

4976.

[8] Biroon, R. A., Biron, Z. A., & Pisu, P. (2021). False data injection attack in a platoon of CACC: Real-time detection and isolation with a PDE approach. IEEE transactions on intelligent transportation systems, 23(7), 8692-8703.

[9] Keijzer, T., Chanfreut, P., Maestre, J. M., & Ferrari, R. M. G. (2024). Collaborative Vehicle Platoons With Guaranteed Safety Against Cyber-Attacks. IEEE Transactions on Intelligent Transportation Systems.

[10] FONDECYT project 1241813: Stochastic string stability for vehicular platooning with imperfect communication channels. Funded by ANID, Chile. Principal Researcher: Francisco J. Vargas.