



Estimation and control design for detection and resilience against faults and cyber-threats in CPSs

PhD offer in the e-Controls/UFAM Research Group and Laboratory of Automatic Control, Mechanics, Industrial and Human Computer Science (LAMIH) — UMR CNRS 8201

Universities	Universidade Federal do Amazonas (UFAM) and Université Polytechnique Hauts-de-France (UPHF)
PhD candidate in	Electrical Engineering and Automatic Control
Duration	3 years
Starting date	March 2026
Location	Manaus, Brazil (18 months) and Valenciennes, France (18 months)
Closing date:	November 21, 2025

Research context

A Cyber-Physical System (CPS) integrates physical and computational processes powered by communication networks. Nowadays, several critical infrastructures may be considered CPSs. Communication network resources are often limited. The unavailability of these resources can compromise system security, since messages, control commands, and sensor measurements may not be transmitted (or altered) due to bandwidth limitations and the concurrency of other transmissions on the network. Therefore, it is essential to develop network control strategies capable of economizing network bandwidth consumption while preserving some security guarantees (e.g., stability and tracking performance) [8, 6].

CPSs are vulnerable to malicious attacks and cyber intrusions. Cyberattacks on the control layer of these systems can be classified as denial-of-service (DoS) attacks [7] and deceptive attacks [3, 9]. DoS attacks impact transmission channels, blocking communication between the controller, sensors, and actuators. Deceptive attacks compromise data integrity by injecting false data into components such as actuators or controllers. Furthermore, the control of these PLCs is subject to additional issues that are generally overlooked in other control systems, such as network-induced delays [10], packet loss [11], and quantization of sensors and control signals due to digital transmission [1, 5, 4]. In addition to malicious attacks, CPSs are also subject to failures in their various sensors and actuators, which can have catastrophic results depending on the criticality of these systems. It is necessary to develop fault-tolerance strategies that can handle the peculiarities of CPSs.

Exploring the advantages of the distributed nature of some PLCs has been neglected in the literature. To overcome this, a critical question to be answered is how to ensure optimal exploitation of the computation offered in distributed settings. Indeed, there are many distributed resilient control results for CPSs, but they attempt to deal with the inherent complexity of these systems rather than exploit the analytical redundancy available due to the independence of subsystems and a variety of sensors and actuators. This project proposes control reconfiguration strategies [2] that include distributed virtual blocks, estimators, and filters, and the exclusion of unreliable elements.

Despite the inherent complexity of CPSs, there are few results that provide security guarantees for the control strategies of these systems obtained based on data. Although CPSs are often extensively instrumented, thus constituting a powerful source of data, and complexity motivates the development of DDC for CPSs, the approaches in the literature still lack indispensable guarantees for critical CPSs of social and economic relevance.

Therefore, this PhD position is offered to the candidates that are eager to develop cutting-edge control and estimation approaches for dealing with the emerging challenges in CPSs. It is expected that the research conducted during the doctorate contributes significantly to at least two of the following topics:

- Fault diagnostics and tolerance;
- Resource-aware control;
- Cyber-secure control;
- Data-driven control.

Main requirements

- Master degree or equivalent in Automatic Control, Electrical Engineering, or related fields
- Excellent background in control theory
- Good programming skills
- Professional English (French and Portuguese skills are desirable but not mandatory)

How to apply

Send the following documents to Iury Bessa (iurybessa@ufam.edu.br), Márcia Luciana da Costa Peixoto (marcialuciana.dacostapeixoto@uphf.fr), and Thierry-Marie Guerra (guerra@uphf.fr):

- Your CV with two academic referees;
- Recommendation letters are also welcome;
- A cover letter explaining why you are interested in this offer and how you can contribute to this project;
- Transcript of records.

Institutions

Universidade Federal do Amazonas (UFAM) is located in Manaus, a place with countless natural resources and welcoming people. Founded in 1909, UFAM is one of the largest and oldest Brazilian universities. The e-Controls research group is installed at UFAM and integrated to its Graduate Program in Electrical Engineering (PPGEE/UFAM). The e-Controls develops research and development in the following six fields: control theory and applications; autonomous and trustworthy computational intelligence; industrial automation and Industry 4.0; safety and security of embedded and cyber-physical systems; future energy systems and electromobility; and autonomous and collaborative robotics.

Université Polytechnique Hauts-de-France (UPHF) is a French public university based in Valenciennes. This project will be developed by the LAMIH UMR CNRS 8201 (Laboratory of

Automation, Mechanics, and Industrial and Human Informatics). LAMIH is a collaborative research unit between the UPHF and the National Center for Scientific Research (CNRS). LAMIH is a multi-disciplinary laboratory and a recognized research entity in transportation and mobility-related fields such as non-polluting vehicles, intelligent transportation, driving assistance, eco-driving, lightweight structures, transport logistics, mobility for all, and intelligent mobility. The laboratory has expertise in human interaction with technical systems.

References

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