université
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FRANCE

Title: Safety and Autonomy of Cyber-Physical Systems.

Description: Today, Cyber-Physical Systems (CPS) are transforming radically our traditional approach to systems and their functionalities, just as the Internet and digital revolution transformed the way we interact with information. They are considered as a key enabler to sustain growth in many future technological developments (industry 4.0, transportation and energy, robotics, manufacturing, medicine…). While the research in all aspects of CPS went forward since mid-2000s, the fact remains that the problem of designing efficient and scalable safety management methods on the way to operational autonomy of CPSs is still widely open since it yields a whole range of new and cross-domain methodological issues. This requires both fine-level management of abnormal events and high-level discrete monitoring to handle holistic off-nominal or dangerous situations. This postdoc research work will focus on the development of adaptive data-driven / model-based methods for designing safety functionalities for CPSs – and is intended to contribute to the design of autonomous / semi-autonomous CPSs that are actually safe enough to be deployed in real situations. A major question is finding ways to validate safety strategies and to demonstrate that a sufficient level of safety can actually be achieved. From a methodological perspective, the research will be a clear departure from hybrid systems and symbolic framework to combine aspects of finite-state and infinite-state systems. A symbolic model will be an abstract description of a purely continuous or hybrid system where each state corresponds to an aggregate of continuous/hybrid states and each label to aggregate of continuous/hybrid inputs. While this approach has been persistently applied to date, it is well-known that it encounters sever scalability barriers. That is why, up to date, this has limited the application of symbolic methods to low dimensional models and simple applications. The objective of this project is to lay the potential concepts for distributed fault management that will surpass scalability and robustness issues which include uncertainty management. The main challenge is to have a tighter coupling between the physical and the networking layers which can be further exploited to investigate fault monitoring, fault tolerance and fault management and recovery issues. The project targets applications related to intelligent buildings - and also safety-critical applications such as future civil aviation operations.

Requested skills: The candidate should have a PhD in control theory with good mathematical background. Good knowledge on symbolic methods and/or interval analysis is highly appreciated.
Duration: 12 months.
Salary: Calculated according to French ANR norms (net salary of about 2100 euros per month).

For more information, please contact:

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