2018-00733 - Distributed simulation of cyber-physical systems

About the research centre or Inria department
Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

Hycomes has been created as a new team of the Rennes - Bretagne Atlantique Inria research center in July 2013. The team builds upon the most promising results of the former S4 team-project and of the Synchronics large scale initiative. Two topics in embedded system design are covered:

- Hybrid systems modelling, with applications to multi-physics embedded systems design;
- Contract-based design and interface theories, with applications to requirements engineering.

Context
A postdoctoral position is available in the Hycomes team at Inria Rennes (France) in the context of the IRL Modeliscale initiative. This position is funded by the Glose project, funded by Safran, and focused on the co-modeling and co-simulation of cyber-physical systems.

Assignment
The objective of the postdoctoral position is to investigate compile-time and run-time techniques for the distributed simulation of large cyber-physical systems. This includes Structural Analysis algorithms for partitioning large Modelica models into networks of FMI components that can be efficiently simulated on a distributed computing architecture, but also novel numerical schemes such as Quantized State Systems (QSS) methods and code-generation techniques for these methods.

Main activities
The postdoctoral researcher is expected to contribute methods, algorithms and software prototypes on one or several of the following topics:

- Compile-time analysis methods (structural, causality and sensitivity analyses, discrete-continuous-dynamics typing, static scheduling of computations) for hybrid Modelica models;
- Discretization schemes amenable to large scale distributed simulation, such as Quantized State Systems (QSS) methods;
- Distributed simulation protocols for networks hybrid systems, based on the FMI standard.

He will work in close collaboration with researchers in Safran and Inria, to evaluate his contributions on case-studies in aeronautics.

Skills
Technical skills: The postdoctoral researcher is expected to have excellent skills in one or several of the following topics: numerical analysis, programming language design, compilation, high performance / distributed computing. Experience in the Modelica language is not required.

Languages: Excellent scientific writing and oral presentation skills in English. Knowledge of the French language is not required.

Relational skills: Excellent team work skills

Other valued appreciated: Experience in the development of research software prototypes, using modern software engineering methods and tools.

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Remuneration
Monthly gross salary: 2653 euros

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