PROPOSITION DE STAGE EN COURS D’ETUDES

Référence : **TIS-DTIM-2016-003**  
(à rappeler dans toute correspondance)  

Lieu : DTIM and DCSD Toulouse

Département/Dir./Serv. : DTIM-LAPS and DCSD  

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**DESCRIPTION DU STAGE**

Domaine d’étude : Embedded Systems, schedulability analysis, probabilistic real-time, stochastic processes

Type de stage : ☑ Fin d’études bac+5 ☑ Master 2 recherche ☐ Bac+2 à bac+4

Intitulé : **Schedulability analysis for probabilities and with probabilities**

Sujet :

This internship proposal is about the schedulability analysis of real-time systems with the use of probabilities.

Today's task models begin including probabilities for a more flexible and accurate representation of the execution behavior. Predictable task execution and schedulability analysis need to face such models. On the one hand, the schedulability analysis has to exploit the richness of the representation with probabilities. On the other hand, the schedulability analysis has to cope with the high complexity of procedures induced by the probabilistic models.

Recent trends in real-time analysis have introduced formal approaches to the schedulability analysis of real-time systems with probabilistic task models [1], [2], [3], [4]. They apply automata, Markov process, or Petri Nets to model the stochastic evolution process of the task application according to a specific scheduling algorithms. Such approaches are still at the beginning of their evolution, and there is plenty of room for improvements.

The internship proposal is to i) prepare an accurate state of the art of the probabilistic approaches to schedulability analysis; ii) propose efficient and generic modeling of the task probabilistic representations for Markov processes or automata; iii) extract schedulability information (in terms of probabilities) about deadline misses and deadline miss ratio from the models applied.

The student will face case studies where tasks execution time and inter arrival time will be described with probability distributions, and the scheduling from the earliest deadline first paradigm will be provided. He/she will be asked to report on different modeling approaches, decide among them the more effective for the scheduling problem approached, and then apply them for the specific problem.

A small bibliography is hereby proposed, including the "sotowatch" automata [5] for the analysis of real-time systems with preemptive tasks, hybrid automata associated decidability issues [6], and schedulability analyses using timed automata [7],[8].

[1] *Stochastic Analysis of Periodic Real-Time Systems*

[2] *An exact stochastic analysis of priority-driven periodic real-time systems and its approximations*
Kanghee Kim, Diaz J.L., Lo Bello L., Lopez J.M., Chang-Gun Lee, Sang Lyul Min; IEEE Transactions on Computer, 2005

[3] *Efficient and robust probabilistic guarantees for real-time tasks*

Laura Carnevali, Alessandra Melani, Luca Santinelli, Giuseppe Lipari; Int. Conf. Real-Time Networks and Sys. (RTNS 2014)

[5] *Preemptive Job-Shop Scheduling using Stopwatch Automata*
Yasmina Abdeddaïm, Oded Maler; proceedings of the 8th International Conference on Tools and Algorithms for the Construction and Analysis of Systems TACAS 2002


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

**Méthodes à mettre en œuvre :**

- ☐ Recherche théorique ☑ Travail de synthèse
- ☑ Recherche appliquée ☐ Travail de documentation
- ☑ Recherche expérimentale ☐ Participation à une réalisation

**Possibilité de prolongation en thèse :**

**Durée du stage :** Minimum : 4 mois Maximum : 6 mois

Période souhaitée : 6 mois

**PROFIL DU STAGIAIRE**

Connaissances et niveau requis :

- Computer science, real-time scheduling, probabilistic modeling.

Ecoles ou établissements souhaités :

DRH/RSPG/octobre 2012