CODECSYS
Contract-Based Design of Cyber-Physical Systems

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CIP Emergence DigicCom
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Abstraction-based controller synthesis* , **

* Approximately bisimilar symbolic models for incrementally stable switched systems,
  Girard, Pola and Tabuada, TAC 2010

** Finite controlled invariants for sampled switched systems,
  Fribourg, Khine and Soulat, FMSD 2014
Compositional abstraction-based synthesis*,**

* Safety control with performance guarantees of cooperative systems using compositional abstractions, Meyer, Girard and Witrant, ADHS 2015
** Game-based synthesis of distributed controllers for sampled switched systems, Fribourg, Khine and Markey, SynCoP 2015
Compositional abstraction-based controller synthesis

- Decomposition of various specifications into parametric contracts:
  - Safety, reachability, stability, etc.;
  - Relation to control-theoretic approaches (small-gain theorems*).

- Algorithms for controller synthesis under assume/guarantee contracts
  - Suitable abstractions of components:
    - under contract assumptions;
    - and architectural constraints (e.g. information flow, shared resources).

- Case studies: intelligent building, cooperative autonomous vehicles, etc.

* On compositional symbolic controller synthesis inspired by small-gain theorems,
  Dalal and Tabuada, CDC 2015
Partnership

The project members gather the necessary expertises in systems & control, specifications and formal methods:

- Laboratoire des Signaux et Systèmes (L2S)
  - Antoine Girard (PI, DR CNRS)
    Hybrid systems, interface control/computer science
  - Luca Greco (MCF U. Paris Sud)
    Resource aware control, stochastic hybrid systems
  - Mohammad Al Khatib (2nd year PhD Student)
    Stability analysis of embedded control systems under timing contracts

- Laboratoire de Spécification et Vérification (LSV)
  - Laurent Fribourg (DR CNRS)
    Formal methods, hybrid systems
Requested support

- PhD thesis: *Compositional controller synthesis for hybrid systems*
  - Supervisors: A. Girard, L. Fribourg
  - Host research team: L2S

- Postdoctoral position (2 years): *Parametric contracts for CPS design*
  - Supervisor: A. Girard
  - Host research team: L2S

- Postdoctoral position (1 year): *Robustness in contract-based design of CPS*
  - Supervisors: L Fribourg, A. Girard
  - Host research team: LSV

- Postdoctoral position (1 year): *Implementation and scheduling of controllers*
  - Supervisors: A. Girard, L. Greco
  - Host research team: L2S
  - **Partial funding by L2S (6 months, 24 kEuros)**

- Operating costs (60 kEuros): conferences, travels, computers, workshop, etc.