Projects

Methodology

What is the project?
- ❑ Independent/individual research project on a topic selected from the list of projects suggested by the instructors (other topics may be discussed and accepted)
- ❑ Initial bibliographic list is provided to motivate the research. Further bibliographic surveys are expected.

Duration: semester

Deliverables (date to be arranged – tentative June 25th):

- ❑ Paper (IEEE conference format)
- ❑ 30 min individual presentation

What is expected?

- ❑ Bibliographical survey
- ❑ Illustrating examples/challenges to make the project tangible
- ❑ Comparative study of techniques and methodologies
- ❑ Computational examples (if applicable)
- ❑ Students are encouraged to submit a paper to an international conference
- ❑ Periodic discussions with the instructors are expected
- ❑ Development of innovative approaches is encouraged

Format of the paper

- ❑ Statement of the problem/challenge; use examples that will serve as background against which the discussion is framed
- ❑ Survey methodology or approach (if applicable)
- ❑ Comparative study of the state of the art
- ❑ Computational examples (if applicable)
- ❑ Conclusions and future work

List of projects

Computational methods for optimal control of hybrid systems
Topics:
- ❑ Dynamic programming techniques for hybrid systems
- ❑ Hamilton-Jacobi-Bellman equation
- ❑ Front wave propagation methods
- ❑ Computational methods: Tsitsiklis, Fast Marching, OUM, Viability Kernel, others.

References:
- ❑ Ian Mitchell, Sethian, Saint-Pierre, Tsitsiklis

Hybrid systems models of maneuver controllers for autonomous vehicles
Topics:
- ❑ Maneuver controllers
- ❑ Synthesis techniques
- ❑ Maneuver switching and execution control

References:
- ❑ LSTS, Frazolli, Varaiya, Anouck Girard

Modelling and control synthesis: computational tools

Topics:
- ❑ Models of computation
- ❑ Synthesis procedures
- ❑ Decidability

References:
- ❑ Tools: Ptolemy, Shift, Statemate

Models of systems with time-varying structure

Topics:
- ❑ Applications?
- ❑ Value of composition
- ❑ Value of structure

References:
- ❑ Dynamic networks of hybrid automata (SHIFT), Birth and death automata, Pi-calculus, Modal networks

Supervisory control in the hybrid systems framework

Topics:
- ❑ Supervisory control of autonomous vehicles in the hybrid systems framework
- ❑ Plan specification and execution control
- ❑ Formal models

References:
- ❑ Raja Sengupta work on language specification
- ❑ LSTS work

Other

Students are encouraged to propose projects for this course.