Master Thesis Proposal

Formal control design for Robotic manipulators: A symbolic models approach

Formal methods – originally developed in software eng. as a framework to find bugs or security vulnerabilities – have been increasingly applied to other fields and many other applications, including control design of Cyber-physical systems. Particularly, one approach has showed success in control design – symbolic models. They are abstract descriptions of the continuous space control systems in which each discrete state corresponds to an aggregate of continuous states of the original system. Since symbolic models are finite, controller synthesis problems can be algorithmically solved. Figure 1.2 schematically describes the symbolic control scheme. The method has shown success to many class of systems, yet remains an open problem when it comes to robotics – particularly robot manipulation.

In this work, we will have the opportunity to work with state-of-the-art control theories and algorithms and be part of an exciting research that bridges robotics and control communities. Be curious, excited and passionate about the mathematics and control research is a fundamental prerequisite. You have the right support, but you will also be expected to work as hard as we do. The work has enormous potential for multiple publications, and will open the gates to any future academia plans from your side.

Type: Research Internship, Master Thesis, Master Internship (The tasks can be split into different work packages)

What do you think?

Tasks include a few of the below:

- Literature review of the methods;
- Mathematical analysis and control theory proofs;
- Implementation of algorithms in Matlab;
- Running solvers in Matlab;
- Possible implementation in the robot arm (with assistance);

Pre-requisites:

- Motivation to work in a team and driving environment;
- Excellent math skills;
- Good control skills;
- Good Matlab skills;
• Basic understanding of robot kinematics;
• Good C++;

Helpful but not required:
• Experience with robot manipulators;

* Related literature: [1] (The tool to be used in this research), [2], [3] [4], [5].

References


