



High speed motion control for over-actuated robots:



Since 1985 HGG is a world leader in designing and building robotic cutting solutions for the heavy steel industry. Its machines are deployed all over the world and are used to rapidly cut steel profiles into free-form shapes.

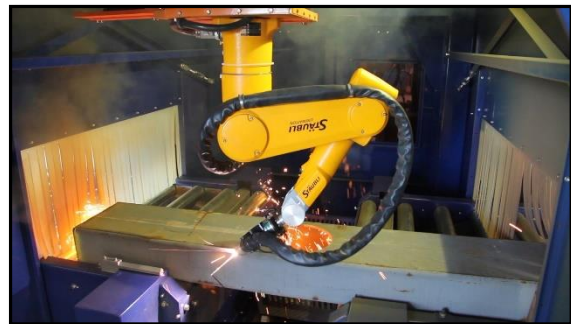
Its machines have been used to build iconic landmarks world-wide such as the London Eye, the Amsterdam Arena and huge stadiums

Ever increasing demands however, on the machine productivity, cutting accuracy and overall size of parts are demanding more and more of the dynamic performance of the cutting robot itself, making the motion controller which handles the planning and execution of the robot motion, vastly important.

Assignment description

Motion generation is an important topic of development for HGG; the need for faster and more precise cutting of parts necessitates the research of a novel control architecture that can simultaneously deal with the dynamic limitations of the robot and the cutting process itself.

- Limits on joint position/speeds/acceleration
- Trajectory tracking on $SE(3)$
- Trajectory planning between poses
- Exploit over-actuation for secondary objectives
- Limits on workspace velocity/acceleration
- Mesh-Mesh collision avoidance
- Online reactive control, the ability to incorporate real-time sensory data in path execution





Why is this hard!

Currently, motion planners are generally unsuitable to plan a set joint trajectories given a specific workspace trajectory.

Moreover, the degrees of freedom of the robot in a large number of industrial applications exceed the number of degrees of freedom needed to complete the task. For example, with cutting, generally the rotation about the tool axis is free. These extra degrees of freedom can be exploited to avoid collisions with the workpiece, reduce joint accelerations and velocity and perhaps to improve accuracy of the final cut result.



Also, the cutting process itself imposes challenging constraints on the workspace trajectory. For example, to achieve good cutting quality having a constant path velocity is important, which renders movements close to or through singular configurations problematic.

Most of the above mentioned challenges are currently open research questions. See for example:

<http://wiki.ros.org/descartes>

<http://ompl.kavrakilab.org/>

Who are we looking for

We are looking for an enthusiastic self-assertive control engineer who wants to put advanced control techniques into the real world.

- Desire to put advanced control strategies into real world applications
- Strong background in non-linear control for rigid bodies
- Understanding of programming under real time constraints
- Affinity with tree searching algorithms





Company supervision

HGG will provide a challenging assignment and the support needed to make it a success. The daily supervision will fall under Matthijs Jansen, graduated at Systems and Control student (Delft University of Technology) and R&D engineer at HGG.

Contact

Want to know more? Send your CV and questions to Matthijs Jansen at maj@hgg.nl.

Matthijs Jansen

R&D Engineer



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