QPS FOR MACHINE CONTROL

Assignment

State-of-the-art control strategies are often formulated as quadratic programs, a class of mathematical optimization problems. Solving medium-sized QPs in 1-10 milliseconds is key to achieve real-time performance in the presence of fast dynamical systems. The Mathware department of Sioux Technologies develops highly efficient QP solvers for the industry. This internship will consider one or multiple open problems regarding non-linear constraints, (approximate) constraint pruning and/or exploiting model predictive control structures.

Activities

The student is will develop algorithms to solve quadratic programs arising in control problems efficiently. The algorithms can be implemented in MATLAB, Python, Julia, C++ or a combination.

Internship overview

- Master Student
- Internship / Graduation
- Mathware
- Location: Eindhoven

Technologies

- Quadratic programming
- Model Predictive control
- (Non)-linear inequalities

SIOUX TECHNOLOGIES

Sioux Technologies
Eindhoven | Mijdrecht | Delft | Apeldoorn

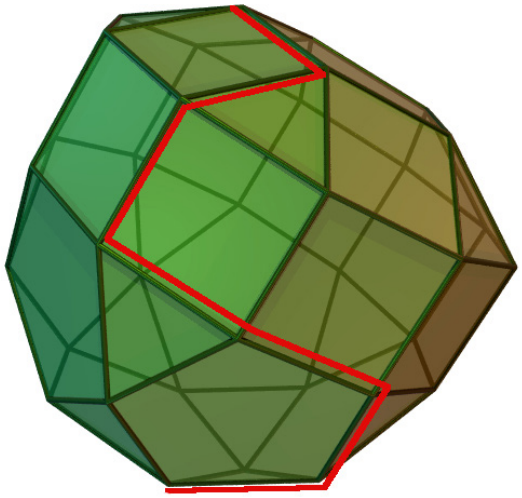
+31 (0)40 2677 100
jobs@sioux.eu
jobs.sioux.eu

Context

Common trajectory constraints are limits on range, velocity and acceleration. Demanding trajectories to be constrained everywhere on a certain interval is a non-linear constraint that does not have an explicit form. By sampling the interval, the constraints become linear. We would like to investigate solutions that do not involve sampling/linearizing.

Constraint pruning eliminates constraints from a set of linear inequality constraints that are redundant. Sioux Mathware currently has a brute force method. The student is to implement more efficient pruning algorithms. Approximate constraint pruning removes constraints that are not redundant, but not very important either.

Model predictive control is a optimal control technique, e.g. minimizing tracking errors. The internal optimization problem is commonly a QP. State-of-the-art embedded solvers like HPIPM do not support rate constraints on the actuation natively. The student is to investigate if faster solver times are possible by implementing such constraints (and other structures) through a custom interior point method.



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- Working on innovative technology
- Challenging, dynamic and varied work
- A comfortable and personal work environment
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- Great carreer opportunities
- Contributing to a safe, healthy and sustainable society

Get in touch!
Would you like to know more about this student assignment?

Contact:
Casper Gruijthuijsen
+31 (0)40 751 61 16
werving_mathware@sioux.eu