Optimization of Robot Placement

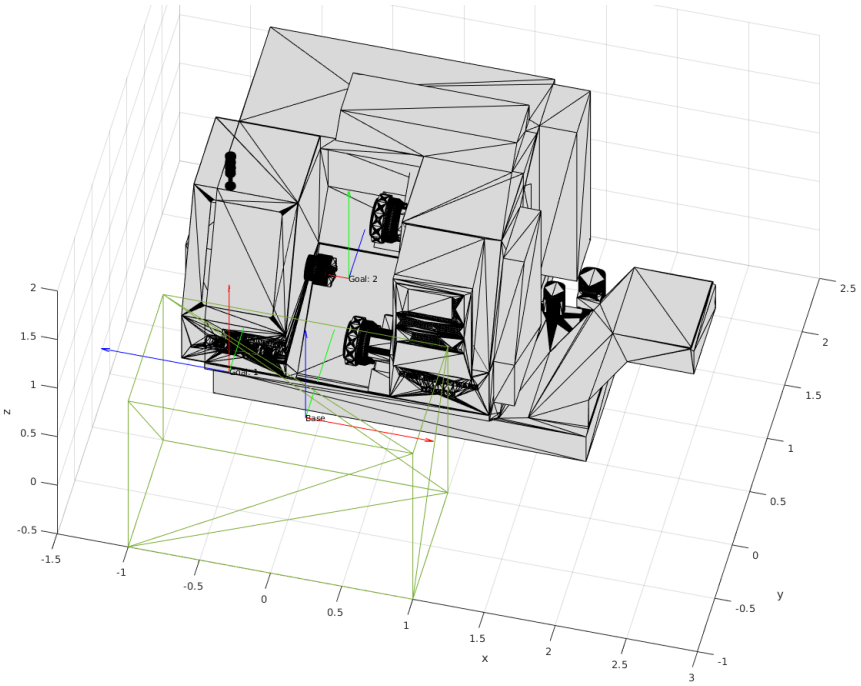
Background

Robots have yet to make an entrance into many industries (outside mass-manufacturing) and the service sector. A major hurdle to their widespread adoption is the complexity of their deployment, requiring costly specialists for every new task one wants to automate. We envision simple tools which help to choose the right robot and its programming given a task and environment specification.

Description

Within this broader goal you will help us to extend our set of benchmark tasks that are representative of real-world robotic tasks (crok.cps.in.tum.de). Based upon these tasks you develop algorithms to optimize the placement of robotic arms. For each task in the benchmark set you will need to define possible placements of the robot's base respecting obstacles in the environment, but also considering them as places where our lightweight arm may be attached to.

Given all the possible placements you will have to find the optimal placement for the robot with a cost function tailored to the problem to automate. This involves different trade-offs, e.g., between cycle times, energy usage, and robot cost.



A machine tending task with possible placements for the robot's base within the green box.

Tasks

- Literature review on optimal robot placement
- Familiarize yourself with the modular robot toolbox
- Build (randomized) factory environments and robotic tasks as a benchmark
- Implement optimization strategies for the placement of the robot

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Research project:
Modular Robotics

Type:
BA/MA

Research area:
Robotics, Optimization

Programming language:
Python, (C++)

Required skills:
Planning, Logic fundamentals, or 3D modeling

Language:
English

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References

[1] M. Althoff, A. Giusti, S. B. Liu, and A. Pereira. Effortless creation of safe robots from modules through self-programming and self-verification. *Science Robotics*, 4(31):1–14, 2019.

[2] M. Althoff M. Mayer. cRoK – A Composable Robotics Benchmark. In *https://arxiv.org/abs/2203.09337*, 2022.

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