Chair of Computing in Civil and Building Engineering
TUM Georg Nemetschek Institute
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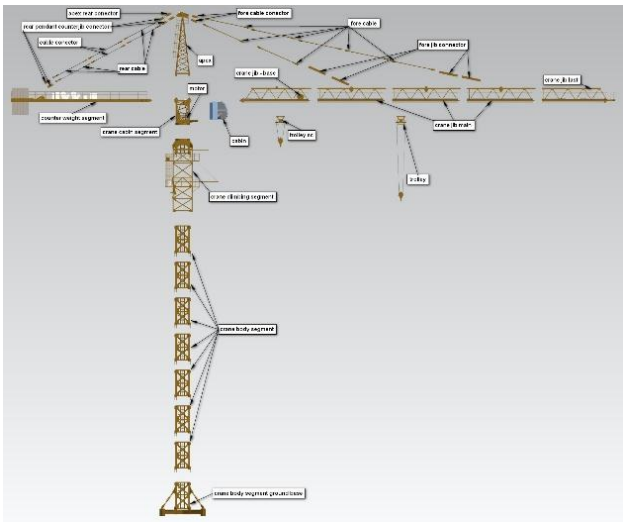
Building a small-scale Tower crane

Description

Tower cranes are essential transportation devices on construction sites, performing heavy lifting and material handling tasks. They typically feature five degrees of freedom (DoF), with three actuated (powered by motors) and two unactuated (radial and tangential swings caused by load dynamics). Thereby, a key requirement is to ensure that the tower crane precisely tracks the planned paths and positions the payload at the specified target location (Burkhardt et al., 2023).

In this project, we aim to design and build a small-scale tower crane in our lab to simulate real-world construction scenarios. The primary objective is to use this scaled model as a testbed for evaluating various transportation tasks and developing advanced control strategies. A key requirement is to ensure that the crane accurately tracks pre-planned trajectories and positions the payload at the designated target location. Precise motion control and dynamic stability will be essential to prevent excessive load swinging and ensure safe operations.

Key responsibilities:



- Define the crane requirements, including payload capacity, joint speed, and component weight.
- Modifying the tower crane components using commercially available items.
- Selecting actuated joints and appropriate stepper motors to meet the requirements.
- Designing the motor housings for the actuated joints.
- Developing a linear axis mechanism for the trolley.
- Designing a mechanism for the crane lift system.
- Refining the crane design using CAD software (e.g. Solidworks) based on the previous modifications.
- Selecting appropriate components for different crane sections.
- Documenting the entire process, from design to construction.

Links

https://www.cee.ed.tum.de/ccbe/labs/robotic-fabrication-lab/

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References

BURKHARDT, M., GIENGER, A., JOACHIM, L., HAALA, N., SÖRGEL, U. & SAWODNY, O. 2023. Data-based error compensation for georeferenced payload path tracking of automated tower cranes. *Mechatronics,* 94**,** 103028.