

ExoskeleTUM @ AM & LFE

Design and Construction of a New Exoskeleton for Paraplegic Patients

Design und Konstruktion eines neuen Exoskeletts für Querschnittsgelähmte

Note on the course language: Our written course material will be in English to give international students the opportunity to join the project. Group work and daily communication however will be, depending on personal preferences, in both, German and English.

Hinweis zur Veranstaltungssprache: Alle schriftlichen Kursmaterialien sind auf Englisch, um auch internationalen Studierenden die Möglichkeit zu geben, am Projekt teilzunehmen. Gruppenarbeit und tägliche Kommunikation können auf Deutsch und Englisch erfolgen, je nach persönlicher Präferenz.

Our Vision

Develop and build a fully actuated lower limb exoskeleton with a students team to remobilize gait impaired patients – that's what *ExoskeleTUM* is about. Our long term project goal is the participation at *Cyathlon* organized by ETH Zurich (<https://cyathlon.ethz.ch/de/cyathlon>). Developing exoskeletons requires knowledge from various disciplines to achieve one common goal: return mobility and autonomy to gait impaired people in a world made for legs. TU Delft shows us, how to do it: *Project March* was established in 2016 and now the team already works on their 7th generation of exoskeleton (see figure 2).

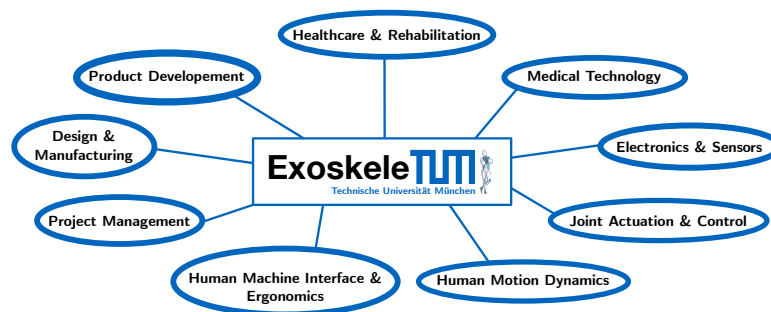


Figure 1: *ExoskeleTUM* as a collaborative students project incorporating numerous fields of research present at TUM.



Figure 2: Project March from TU Delft. The student organization supported by the Technical University Delft currently works on the 7th generation of their exoskeleton. The project started in 2016. Reprinted with permission from <https://www.projectmarch.nl/en/project-march>.

The Project Seminar

In this students seminar you will start to develop the first prototype of an exoskeleton in an interdisciplinary team. The mechanical team is supervised by Alexandra from the Chair of Applied Mechanics (**AM**), the ergonomics teams are supervised by Christina and Martin from the Chair of Ergonomics (**LFE**). All teams work closely together and meet on a regular basis to exchange their ideas and findings. Project kick-off, a midterm presentation and close up sessions are a joint events for all teams.

You may to apply for ONE of these three teams:

Team 1 @ **LFE**: Digital human modeling and simulation of physical human-exoskeleton-interaction

- Calculation of joint reaction forces and human-exoskeleton interaction forces
- Design of control strategies
- Simulation based optimization of exoskeleton design and kinematics

Team 2 @ **LFE**: User centered design of human machine interaction

- Analyzing user needs and context of use
- Identifying feasible interaction modalities
- Modeling data flow between human and exoskeleton
- Prototyping of useful, efficient and effective exoskeleton modules

Team 3 @ **AM**: Mechanical hardware design

- Mechanical development of actuation strategies: motor design and control
- Hardware design: resulting forces, ground contact, joint design, power supply, structural mechanics
- Global motion planning strategies: walking sequences, standing, sitting, balance

Looking forward to meet you in our seminar!

Warm regards,

Alexandra, Christina and Martin



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