Design of a compact active hip prosthesis with human-like range of motion and torque

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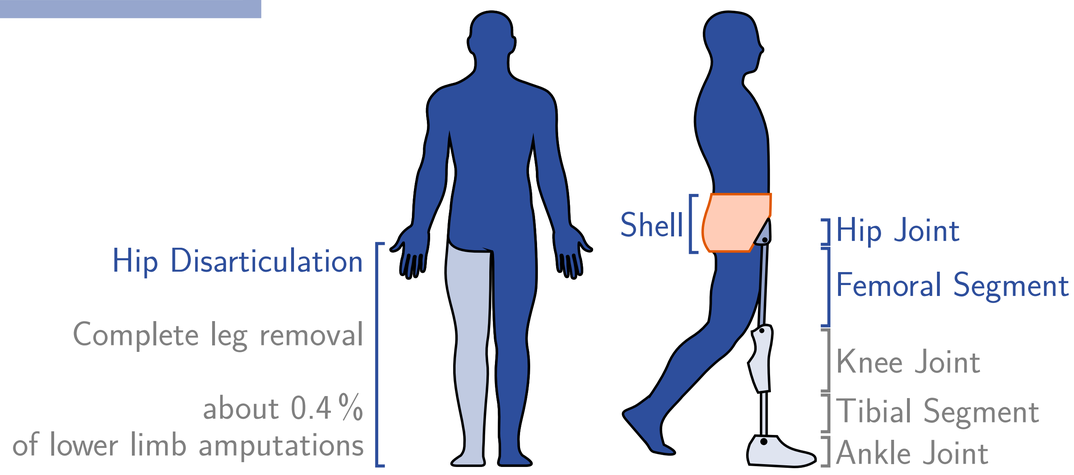
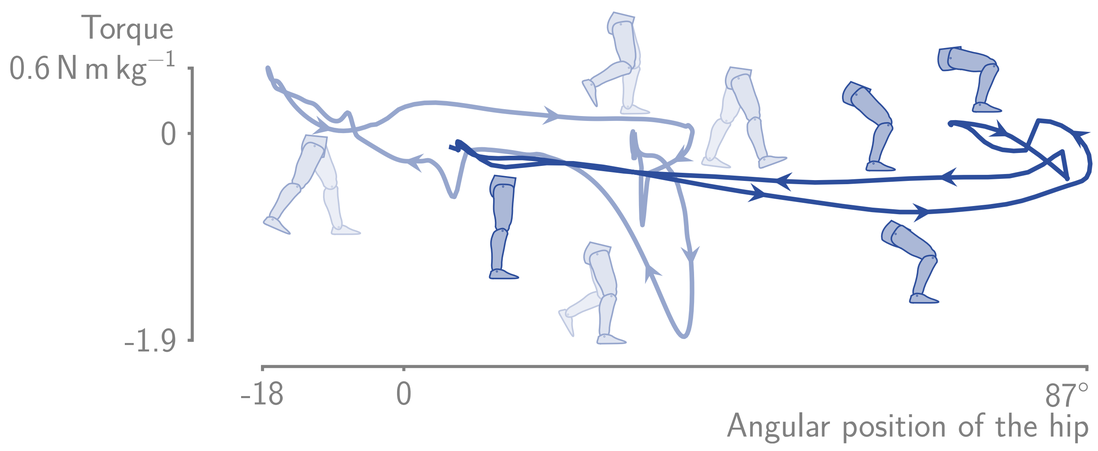
Current external hip prostheses are insufficient for people with hip disarticulation

They
- are passive — High energy cost to ambulate
- do not follow healthy biomechanics
  - Center of rotation misalignement
  - leads to asymmetry and thus comorbidities
- are bulky — Do not fit in the thigh volume

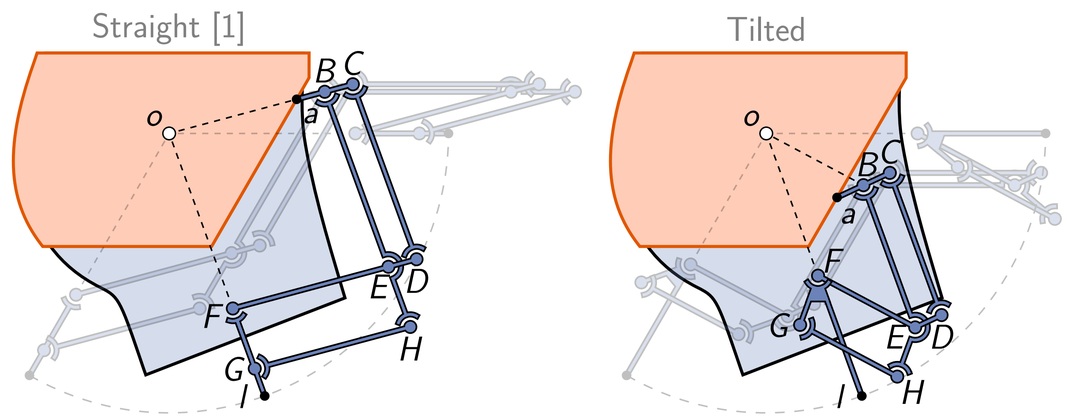
We designed an active tilted double parallelogram mechanism to solve those issues



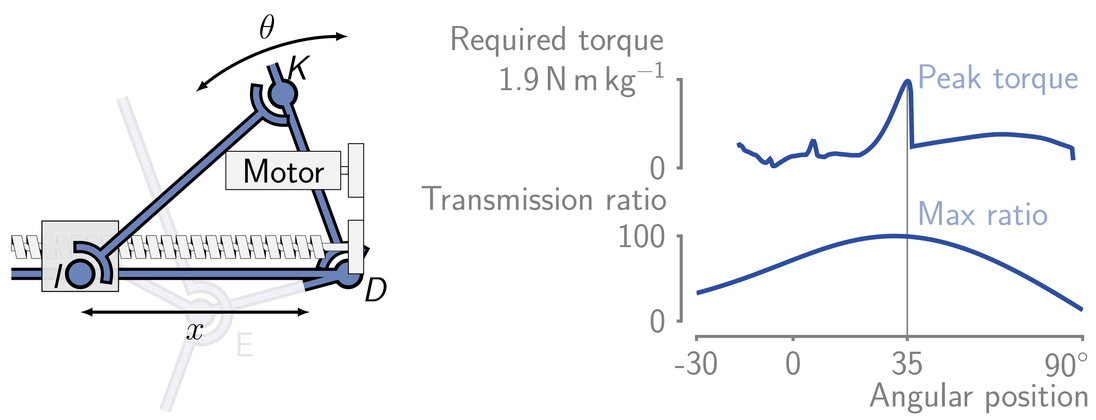
Walking and sitting need large range of motion and torque



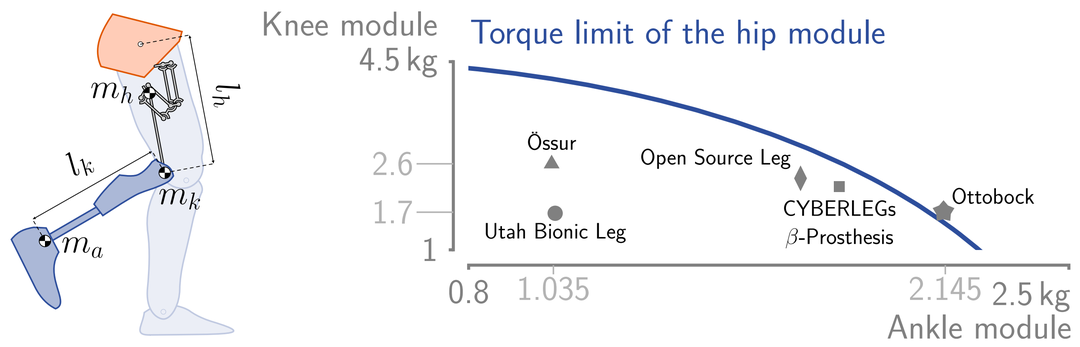
A tilted double parallelogram mechanism aligns axis of rotation and fits into the thigh volume



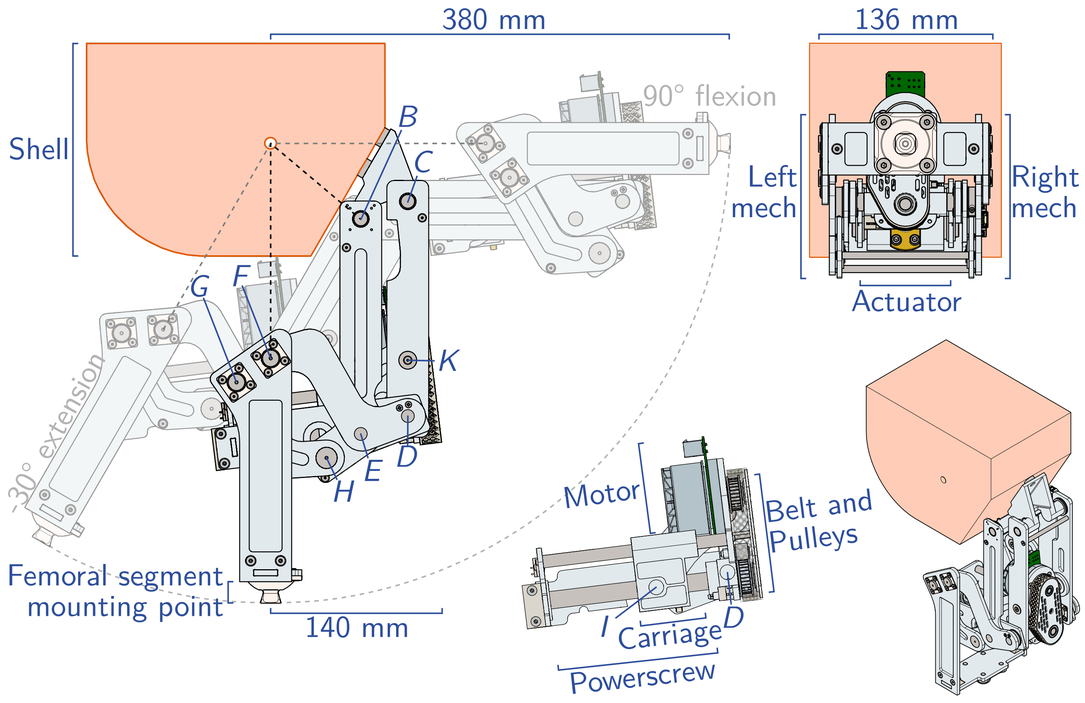
A non-linear transmission provides torque when needed



The hip module is compatible with existing ankle-knee prostheses

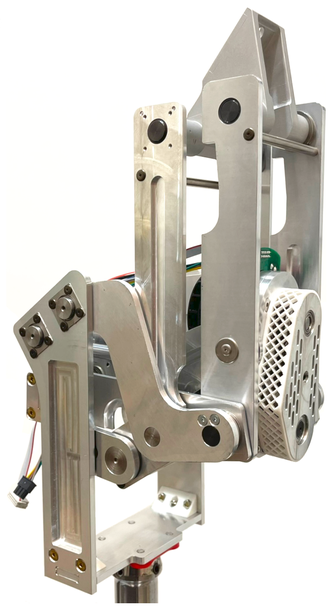


The actuator is held between the duplicated mechanisms



The prototype is assembled and ready for validation tests

It
- is active — Can reduce energy cost to ambulate
- implements the tilted double parallelogram
  - Aligns the center of rotation
  - Follows natural biomechanics
- is compact — Fits inside the thigh



Future Work:

Design of a controller with new challenges
- Selection of the driving signal(s)
- Management of transitions

Testing
- Testbench
- Users

Louis Devillez is a research fellow of the Fonds de la recherche Scientifique - FNRS (#40011487)

[1] Xinwei Li et al. (2021-01). "Design and Optimization of a Hip Disarticulation Prosthesis Using the Remote Center of Motion Mechanism". In: *Technology and Health Care* 29.2, pp. 269–281