Universität Stuttgart

Institut für Nichtlineare Mechanik

Masterarbeit

Simulation and Experimental Evaluation of an Elastic Robot Leg

The goal of this project is to investigate the potential use of continuously deformable structures in the legs of legged robotic systems. The proposed novel design is inspired by functional prosthetic limbs used for running and other exercise activities. In this project, we seek to simulate the behavior of such a leg, build a hardware prototype, and verify the simulation results in experiments. The topics covered in this project thus span from developing tools for numerical simulation of a continuous deformable structure, to implementation and instrumentation of a mechanical testbed.

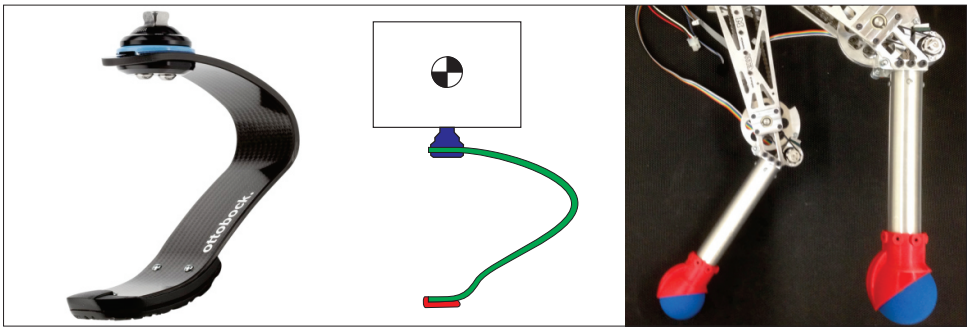

Abbildung 1: Deformable structures as they are used in prosthetic devices are explored for the use in legged robotic systems.

In particular, we plan to build a mechanical prototype of a passive hopper that will be instrumented with inertial measurement units and reflective markers for motion capture. This prototype will consist of a rigid main body and a leg that is made from a cold-bend steel beam and a small rubber foot. By guiding the system on rollers between two plates of glass, we will restrict its motion to two dimensions. With this system, we will conduct passive drop-and-bounce tests and evaluate how well we can predict this motion in simulation.
Your tasks will include the necessary steps for building the hardware, instrumenting it, using computer vision and sensor fusion to record its motion, and processing the resulting data. In addition, you will be developing the simulation, where we will put a strong emphasis on simulation speed, as we seek to employ the resulting simulator in design, optimization, and control. A particular challenge in this context will be the simulation of the unilateral contact between the ground and the leg, which renders the problem hybrid.

Themengebiete:	Robotics, Dynamics
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