Universität Stuttgart

Institut für Nichtlineare Mechanik

Bachelorarbeit

Studienarbeit

Masterarbeit

Investigating the properties of a hip-CVT

Themengebiete:	Dynamik mech. Systeme, Simulationstechnik
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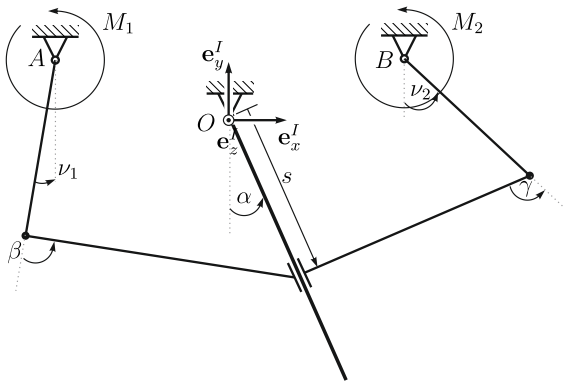
Vorkenntnisse:	Technische Mechanik, Systemdynamik, Matlab

When walking on flat terrain, bipeds (including humans) can take advantage of natural dynamic motions. That is, rather than actively moving their limbs, they relax their joints and let the limbs swing freely like coupled mechanical pendula. This allows them to achieve a desired motion with hardly any effort. On rough terrain or when climbing stairs, this strategy does not work and limb motion has to be controlled rigidly. In biological systems, switching the actuation from loose to rigid is achieved by pairs of muscles that can relax or co-contract. In this project we seek to evaluate a novel drive mechanism for a robotic hip joint that has similar properties. It can be considered as a continuously variable transmission (CVT). Two motors are used to move the hip joint and can additionally control the position of a slider that regulates the effective lever arm of the two motors, thus changing it from rigid to loose. In this thesis, you will derive the kinematic and dynamic equations of motion for this mechanism and implement them in MATLAB/Simulink. Using your model, you will analyze torque- and power-routing in the transmission and you will create an estimate of the overall power consumption by the motors. In addition you will consider different kinematic designs and you will derive and implement a controller to track desired kinematic and kinetic trajectories.



CVT based on five-bar mechanism

Minitaur: robot with a five-bar mechanism for foot placement