Wednesday, Feb 6 / 16:15 - 17:30

Session Name and Room: **Prosthetics : Lower Limb - 12** **Room 1.03**

Abstract Title: **A Biomechanical Model For The Estimation Of Dynamic Interactions At The Transfemoral Socket Interface**

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Introduction

For the analysis of the human gait with prosthesis and the design of prosthetic devices, the knowledge of fundamental dynamic interactions at the user-prosthesis interface is required. A direct measurement of these interactions, including forces, torques, and powers, is complex and necessitates additional sensors in the prosthesis.

Methods

In this work, a biomechanical model for the estimation of dynamic interactions at the transfermoral interface in sagittal plane is presented. By applying an inverse dynamic simulation, the normal force, torque and power at the interface are computed for different gait scenarios and lengths of the residual limb. The biomechanical model consists of multi-body system dynamics models of the legs and the trunk. The sound leg is modeled by three rigid bodies for thigh, shank, and foot as well as three rotatory joints representing the hip, knee, and ankle joint. The model of the leg with prosthesis is obtained by partitioning the rigid body of the thigh into a residual and a prothetic limb and linking both partitions by virtual joints representing the transfemoral interface. The parameters of the residual limb are identified by fitting the inertial specifications to a detailed geometric model of the human thigh.

Results

The simulation Results provide essential information for gait analysis and prosthesis design.

Discussion

The power characteristics allow to evaluate the effort that has to be expended by the prosthesis user, while the torque characteristics show the influence of different prosthesis lengths on the loads of the residual limb. The normal force characteristics describe the impact of force peaks introduced by ground reactions and are a measure for the pressure distribution at the prosthesis stem.

Conclusions

The presented biomachnical model is a first approach towards a comprehensive simulation environment for the human gait with prosthesis and will be further enhanced in accuracy and applicability.