



August 7, 2017

MASTER'S THESIS  
for  
N.N.  
Student ID XXXXXXXX, Degree XX-XX

## Link Segment Model for Functional Forward Reach

### Problem description:

Maximum Functional Reach is a measure to evaluate balance performance as a function of age, impairment and tactile interactions [2]. Functional reach can be used to quantify the extent of forward movement during a forward reach activity. Steinl et al. showed that the application of a light contact force at the wrist during a forward reach experiment, improved the maximum forward reach as well as decreased the sway in the reaching subject [3]. Sway measures the rate of movement about the mean position in the anterior posterior, medio lateral or vertical direction of the body marker in concern i.e., center of pressure (CoP), hand, chest, pelvis etc. These performance measures for forward reach are restricted to evaluation and comparison of kinematic variables and there lies a need to understand the kinetics of body movement. Holden et al. showed using an inverted pendulum model the force range for stabilizing the sway during one legged standing [1]. An insight into the metabolic requirements such as energy and power of dissipation by the muscles will help in understanding body's way of adapting to the task of forward reach.

### Tasks:

- Literature research on forward reach and link segment models.
- Developing a link segment model of the human body capable of reproducing forward reach.
- The model should consist of an ankle joint, hip joint and center of mass pivoting about the hip joint.
- Foot and leg length will depend upon the human.
- Comparing model based and experimental data.

Supervisor:           Dipl.-Ing./ M. Sc. Your Name  
Start:                   XX.XX.2017  
Intermediate Report: XX.XX.2017  
Delivery:             XX.XX.2018

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### Bibliography:

- [1] Holden M., Ventura J., and Lackner J. Stabilization of posture by precision contact of the index finger. *Journal of Vestibular Research*, 4(4):285–301, 2017.
- [2] Duncan P.W., Weiner D.K., Chandler J., and Studenski S. Functional reach: a new clinical measure of balance. *Journal of Gerontology*, 45(6), 1990.
- [3] Steinl S.M. and Johannsen L. Interpersonal interactions for haptic guidance during maximum forward reaching. *Gait and Posture*, 53:17–24, 2017.