



Master of Science – Biomedical Engineering
Thesis Proposal

Comparing musculoskeletal modelling IK for clinical use

At UKBB, gait analysis is utilised routinely to decide on performing complex surgical procedures. The decision-making process relies in part on the results of musculoskeletal modelling which estimates the muscle and joint contact forces during walking. The inputs of musculoskeletal modelling are the movement of the body segments tracked with external markers as well as the force applied to the ground by the feet (the ground reaction force, GRF) during walking. These inputs are captured routinely for each patient undergoing measurements at the gait laboratory.

Several musculoskeletal modelling packages exist, each with its own advantages and specificity. Currently, we use the Anybody commercial package. Several other packages exist (OpenSim, CusTOM, BioRBD), most are open sources which may facilitate further developments. Importantly, the outputs of the packages have been shown to differ in the specialised literature but there is limited understanding as to why. The objective of this thesis is to compare Inverse Kinematics (IK) results obtained with OpenSim and CGM (Conventional Gait Model, in Vicon Nexus), investigating the difference between model definition, coordinate systems and IK computation methods. The analysis will be performed first on a cohort of healthy subjects, and then extended to representative patients collected in our gait laboratory. We expect the student will form a deep understanding of the different steps involved in musculoskeletal modelling applied to clinical data.

Nature of the Thesis

Experimental: 20%
Programming: 60%
Documentation: 20%

Specific Requirements

Some experience with marker-based motion capture
Excellent programming skills with Matlab

Supervisor

PD Dr. Morgan Sangeux, Scientific and technical leader of the Neuro-Orthopaedics group Universitäts-Kinderspital beider Basel
Dr Matilde Bertoli, PostDoc of the Neuro-Orthopaedics group Universitäts-Kinderspital beider Basel

Contact

PD Dr. Morgan Sangeux: morgan.sangeux@ukbb.ch
Dr. Matilde Bertoli: matilde.bertoli@ukbb.ch

