Erica Montefiori

Erica Montefiori received her Master degree in 2015 from the university of Pisa and joined MultiSim in May 2016 as research assistant. Working on MultiSim, EM developed a broad expertise, spanning from multibody dynamics and musculoskeletal modelling to human movement and gait analysis. She also gained excellent knowledge of medical imaging techniques that support the development of subject-specific modelling approaches. Erica has co-authored 5 published papers and 2 more are under review and is expecting to submit her PhD thesis as a staff candidate in summer 2019. In MultiSim2, EM will improve the modelling of the muscle within the MSK model, further expand her knowledge into the multi-scale aspects of the project, and gain new expertise in the pre-clinical applications by supporting the mouse model development.
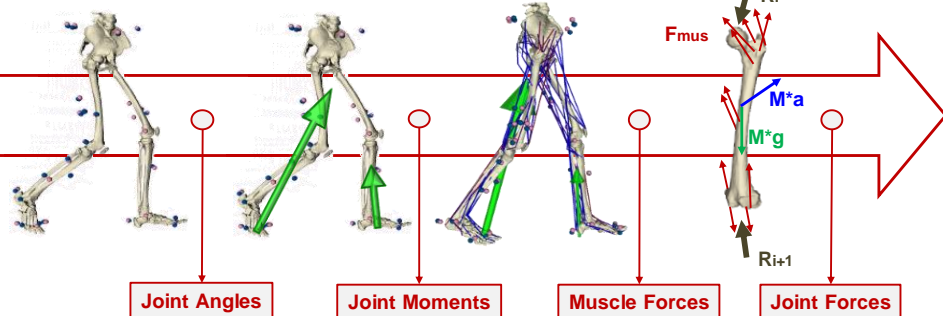
Dynamic simulations of gait

Gait analysis data

MRI data

Inverse Kinematics	Inverse Dynamics	Static Optimisation	Joint reaction analysis

R_i

F_{mus}

$M*a$

$M*g$

R_{i+1}

Joint Angles

Joint Moments

Muscle Forces
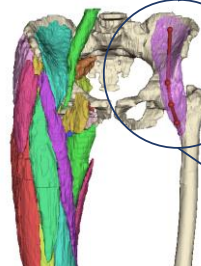
Joint Forces

OpenSim

Model personalisation

3 DOF hip

1 DOF knee

1 DOF ankle
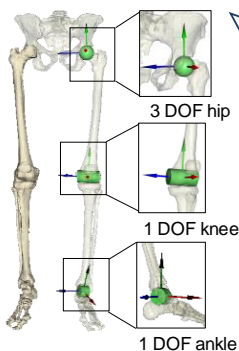
Identification of the joint axes based on joint morphology

Identification of the muscle line of action from the muscle segmentation

Individual muscle volume allows to personalise muscle parameters such as **maximal isometric force**

Erica Montefiori

Publications

Montefiori, E., Modenese, L., Di Marco, R., Magni-Manzoni, S., Malattia, C., Petrarca, M., Ronchetti, A., de Horatio, L. T., van Dijkhuizen, P., Wang, A., Wesarg, S., Viceconti, M., Mazzà, C.; MD-PAEDIGREE Consortium ,"Investigation of the link between joint impairments and gait biomechanics in patients with Juvenile Idiopathic Arthritis". Ann Biomed Eng (Accepted 2019)

Montefiori, E., Modenese, L., Di Marco, R., Magni-Manzoni, S., Malattia, C., Petrarca, M., Ronchetti, A., de Horatio, L. T., van Dijkhuizen, P., Wang, A., Wesarg, S., Viceconti, M., Mazzà, C.; MD-PAEDIGREE Consortium (2019), "An image-based kinematic model of the tibiotalar and subtalar joints and its application to gait analysis in children with Juvenile Idiopathic Arthritis", J Biomech, 85, pp 27-36

Modenese, L., Montefiori, E., Wang, A., Wesarg, S., Viceconti, M., Mazzà, C. (2018), "Investigation of the dependence of joint contact forces on musculotendon parameters using a codified workflow for image-based modelling", J Biomech, 16(3), pp 216-223

Greatrex F., Montefiori E., Grupp T., Kozak J., Mazzà C. (2017), "Reliability of an Integrated Ultrasound and Stereo-photogrammetric System for Lower Limb Anatomical Characterisation", Appl Bionics Biomech, ID:4370649, 8 pp

Hannah I., Montefiori E., Modenese L., Prinold, J., Viceconti M., Mazzà C. (2017), "Sensitivity of a juvenile subject-specific musculoskeletal model of the ankle joint to the variability of operator dependent input", Proceedings of the Institution of Mechanical Engineers, Proc Inst Mech Eng H, 231 (5), pp 415-422

Other Achievements

Conference presentations:

- CMAS2019, Sheffield, UK
- CMBBE 2019, New York, USA
- SIAMOC 2018, Florence, Italy (Conference proceedings in Gait&Pos, 66(1):s28)
- ESMAC 2018, Prague, Czech Republic (Conference proceedings in Gait&Pos, 65(1), pp 216-218)
- VPH 2018, Zaragoza, Spain
- WCB2018, Dublin, IE
- 3D-AHM 2018, Salford, UK
- ISB 2017, Brisbane, AU
- ESB 2016, Lyon, France

Prizes:

- 2018 Best presentation, Engineering Researcher Symposium, Sheffield, UK (scientific audience)
- 2018 Best poster, The Kroto Research Inspiration Competition, Sheffield, UK (general public)

Events and outreach:

- Presenter of the OpenSim workshop, CMAS2019, Sheffield, UK (scientific audience)
- Challenge developer for the MultiSim Modelathon Sheffield, UK (scientific audience)
- Presenter, Sheffield Festival of Science (general public)