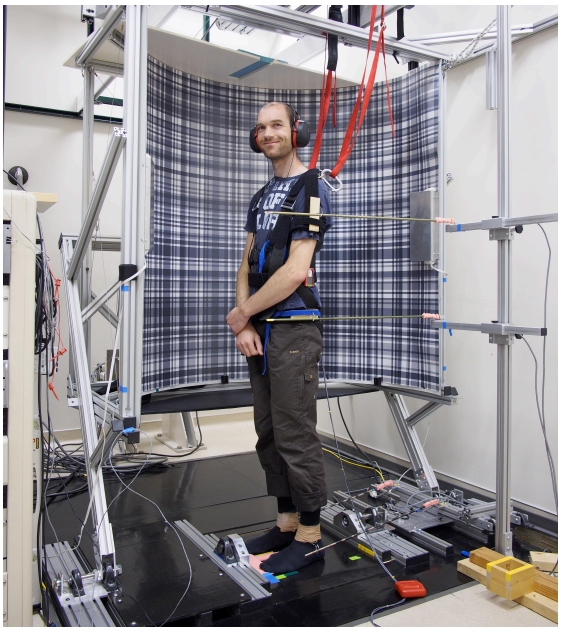
Master Thesis MST/ESE

Modelling and Identification of the Human Balancing System



Humans use sensory information from three different sensory systems to maintain balance during upright stance: the vestibular organ (a biological IMU), the visual system, and the angular orientation to the ground using proprioception. The sensory information is fused by the central nervous system to generate context dependent muscle contractions.

During the last 15 years, experiments and control models to identify the human balance system were developed. The models are able to reproduce experimentally measured body sway responses to mild perturbations, e.g. by tilting the support surface. However, the neural human balance system is highly non-linear. Current approaches are not well suited to investigate the observed non-linear properties. Therefore, it is desirable to develop and use new nonlinear identification methods, which overcome these limitations.

The goal of the Master Thesis is to reformulate existing models mimicking the human balance system in a state space formulation, and to use nonlinear optimization for parameter estimation based on experimental data. Software and methods will be provided by the Systems Control and Optimization Laboratory at the University of Freiburg, while experimental data and methods will be provided by the University of Konstanz with a device similar to the one shown above.

Keywords: system identification, programming, optimization

Notes: Travel expenses for regular meetings in Konstanz can be provided.

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Freiburg, 1.12.2016