Nonlinear System Identification during Repetitive Peripheral Magnetic Stimulation (RPMS)

The repetitive peripheral magnetic stimulation (RPMS) is an innovative approach in treatment of central paresis e.g. after stroke. Our recent goals in research aim to proof beneficial effects of the RPMS-therapy on the one hand and to improve the therapy and its assessment with control engineering methods.

In this talk, first the basic principle of RPMS and exemplary results of clinical experimental studies will be presented. Secondly a model of the RPMS-induced limb motion is presented. This model is the basis for the research goal: On-line spasticity quantification during RPMS.

In order to adapt the model parameters to the individual a nonlinear on-line system identification method is proposed. Physiological systems may be complex and detailed so that in many cases macroscopic models of the dominant characteristics are built. Therefore, mathematical descriptions of these models and respective parameter identification methods have to cope with uncertainties.

In this talk a separable nonlinear regression model of Hammerstein structures that maximizes the possibility of incorporation of a priori knowledge and is still flexible to structural uncertainties will be presented. Also a robust on-line identification method based on the Levenberg-Marquardt Algorithm is presented that works in a reduced parameter space, due to the separability of the model equation.