**Presentation abstract**

Life is movement and movement is life. This is why increasing emphasis is given to methods preventing movement disorders and restoring movement performance. However, coordination between perception and action is required to interact with the environment successfully. This is done by the systematic activation of muscles by the central nervous system (CNS), which not only initiates the intended movement but also controls its execution. In disease this systematic muscle activation strategy is often changed: either controlled by the CNS to prevent injured structures from additional damage or uncontrolled due to a destruction of those parts of the CNS which are involved in movement control.

In human movement and locomotion the active contraction of a muscle is initiated by the electrophysiological excitation of a pool of motor units (MUs). Since Surface-Electromyography detects the electrophysiological signal generated on the skin-surface by the muscle during excitation, it is a well-established procedure utilised in studies of muscle function, muscle co-ordination and movement control. In general, the surface electromyographic signal (sEMG) reflects the degree of activation of single muscles.

However, if recorded synchronously from different muscles, the muscular co-ordination pattern can be detected, which gives insight into the control strategies applied by the CNS. Furthermore, detailed information about the activation of single MUs can be gained, when special recording- and signal-processing-techniques are applied. The so called High-Spatial-Resolution EMG (HSR-EMG) is based on the use of a multi-electrode array in combination with a spatial filter processing. The methodology is able to detect the single MU activity non-invasively even at maximal voluntary contraction forces.

The purpose of the lecture is to present different sEMG and HSR-EMG applications and to demonstrate their relevance for prevention, diagnosis and therapy of musculoskeletal and neuromuscular disorders. Additionally, examples about how the CNS controls the muscular coordination in health and in disease will be given. However, beside the strong prospects of sEMG in getting insight into the control of movement, also some pitfalls in sEMG interpretation will be mentioned, which have to be regarded when using sEMG in clinical applications.

**Bio of Professor Catherine Disselhorst-Klug**

Prof. Catherine Disselhorst-Klug and the Head of the Department of Rehabilitation & Prevention Engineering. Her initial research focussed on understanding muscular control mechanisms in the human body and movement physiology. This formed the basis for her present research activities which focus on kinematic and kinetic analyses and modelling of physiological and pathological movements based on biomechanics and on neuromuscular performance. Her particular research interests are focused on the development of methods improving diagnosis, prevention and rehabilitation of musculoskeletal dysfunction. This encompasses among others the development of devices for intelligent technically assisted rehabilitation and early diagnosis and prevention of musculoskeletal dysfunction.

She has more than 50 Publications in peer reviewed journals and 10 contributions to specialized books. Additionally, she has served as a Council Member of the International Society of Electrophysiology and Kinesiology (ISEK) for eight terms and has been the president of ISEK from 2004 to 2006. Presently, she is a Council Member of the International Society for Biomechanics (ISB). She has participated and partly been responsible for the EU-Projects SENIAM and NEW as well as the national large-scale projects ForSaTum and inno.MED (Ziel2 NRW) as well as OrthoMIT (BMBF).