Muscle load sharing
An energy-based approach

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Musculoskeletal models are a valuable tool in the study on human movement. When the kinematics and external forces that act on the human body are known, such models can be used to calculate the resultant joint moments for a given posture or motion by simple Newtonian mechanics. It is, however, difficult to determine the contribution of the individual muscles to these moments. In general, there are more muscles crossing a joint than is theoretically necessary in order to perform all possible movements. This is called the indeterminacy problem or the load sharing problem. Inverse dynamic models often make use of cost functions to solve this load sharing problem. The use of a cost function is based on the assumption that the central nervous system controls the musculoskeletal system in an optimal manner, optimising a certain cost. It is however difficult to find the right criterion, since it is unknown which quantity is optimised in real life. Therefore, only assumptions can be made. It has often been assumed that movements are performed by minimising energy consumption. Nevertheless, most cost functions are mechanical cost functions and up till now, no cost functions have been defined, which are based on the calculation of muscle energy consumption. The aims of this thesis were to define a cost function that represents muscle energy consumption and to validate this cost function with a metabolic parameter.

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