

Sensitivity Information for Biomechanical Models

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In recent years numerical methods start to pour into the biomechanical field of applications. In contrast to technical mechanics, human body parts, joints or forces are typically more complex than using easily idealised metal objects. Especially force elements like muscles show additional difficult numerical behaviour. Muscles connect two points of the skeleton, but touch the skeleton at one or more additional areas at joints. These areas of contact are implicitly defined and need to be calculated in an analytical or numerical fashion. Furthermore the muscle may loose contact, which leads to discontinuities of the force. Besides the modelling task, integration schemes are needed, that treat these difficulties correctly and efficiently.

Because of the complexity, it is typically very strenuous to choose initial values, parameter or controls, that lead to the desired movement. Optimisation methods could be used to assist the modeller in this task. Efficient optimisation methods need sensitivity information, that must be supplied by the model.

In this talk we will present extensions to MbsNat, an object oriented model generator based on Natural Coordinates, in the form of classes implementing the previously described features. This component works together with integration schemes (e.g. MBSSIM) and optimisation methods (e.g. Parfit++) used in our work group.