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Incorporation of Reduced Isogeometric Finite-Element-Models in Flexible Multibody Simulation

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The method of flexible multibody systems is a well-established approach for the analysis of dynamic mechanisms, whose components undergo large nonlinear motions and deformations. Depending on the problem the flexible bodies can be modeled using, for instance, a nonlinear finite element approach, the finite segment method or the floating frame of reference formulation [3]. If the deformations are small and elastic the floating frame of reference formulation is often the most efficient approach. Thereby the large nonlinear motion is described using a reference frame, while the deformations are approximated by a set of global shape functions multiplied by time-dependent elastic coordinates [2].

A general way to determine the set of global shape functions is to first create a linear finite element model of the flexible body. Then model order reduction techniques can be applied to derive suitable global shape functions from the finite element model. This procedure is well-described, tested, and standardized for isoparametric finite element models. In contrast, there are only few results on the usage of the strongly developing isogeometric finite element approach [1] in the modeling of flexible multibody systems. Thus, a procedure is presented in this talk to incorporate isogeometric finite element models in multibody systems modeled with the floating frame of reference formulation. In detail, the procedure includes the generation of the isogeometric finite element model, modal reduction and the computation of the so-called standard input data, a standardized data set to completely describe flexible bodies in multibody systems [4]. A slider-crank mechanism with a flexible piston-rod is used as testing and application example.

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