Parameter Identification in Multibody Systems in Frequency Domain using Adjoint Fourier Coefficients

Karin Nachbagauer, Stefan Oberpeilsteiner, Thomas Lauß, Prof. Wolfgang Steiner
University of Applied Sciences Upper Austria, Campus Wels
University of Applied Science Upper Austria, Campus Wels

The field of optimal design of multibody systems often includes an inverse problem to solve, as e.g. the parameter identification in an engineering multibody application. The inverse problem could be defined as an optimization task described by minimizing a cost function. The gradient of this cost function can be computed very efficiently also in complex multibody systems when incorporating the adjoint method.

In case of the identification of parameters in oscillating multibody systems, a combination of a Fourier analysis and the adjoint method is a promising approach. In most cases of the classical adjoint method in time-domain, the results lead to some kind of best-fit solution which means that high frequency components with low amplitudes are not considered. However, the identification of parameters which influence the system at particular frequencies or frequency ranges is an important issue. The basic idea is to compute the Fourier coefficients for the relevant oscillations and include the according amplitudes in the cost function. Now, spectral data from a test bench can be used to identify the amplitude response.

In order to reduce computational effort, the cost function is rewritten here from the classical Lagrange form to Mayer form leading to constant adjoint Fourier coefficients. This powerful combination of the Fourier analyses and the adjoint method for the computation of the cost function in Mayer form is presented here.