Universität Konstanz
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Arbeitsgruppe Numerik

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Im Oberseminar

Numerik

wird am

Dienstag, dem 4. Dezember 2012,

folgender Vortrag gehalten:

Dipl.-Ing. Ortwin Farle
Universität Saarbrücken

"Parametric Order Reduction for Non-affine Parameters"

Zeit: 10.15 Uhr
Raum: F 424

Interessenten sind herzlich willkommen!

gez. Stefan Volkwein

Abstract: The aim of model-order reduction (MOR) is to approximate the input-output behavior of a given high-dimensional system by that of a low-order one, which is much faster to evaluate. The systems considered in this talk are finite element (FE) discretizations of linear time-invariant microwave structures. Besides frequency, they may exhibit several other parameters, such as material properties or geometric parameters. To preserve these additional parameters in the reduced order model (ROM), methods of parametric model-order reduction (pMOR) have been developed. Most of them are of projection type. A crucial prerequisite for this class of algorithms is affine parameter dependence, i.e. all operators present in the system description need to be representable by sums of parameter-independent operators weighted by parameter-dependent functions. This talk will focus on systems featuring non-affine parameter dependence.
The first type of problem I consider is the efficient and reliable far field computation of phased antenna arrays over a broad frequency band and wide ranges of steering and look angles. The difficulty lies in the non-affine parameter-dependence of the near-field-to-far-field operator. However, using the Empirical Interpolation method, it is possible to compute an affine decomposition, which allows the application of projection based MOR for the far-field computation. To certify the accuracy of the ROM, I will present a posteriori error bounds that can be computed very efficiently.
Geometric parameters are the second class of non-affine parameters to be discussed in this presentation. What is special is that these parameters enter the FE system in implicit form. The proposed MOR framework consists of two parts: The first step reestablishes affine parameter dependence, using an interpolation approach. In the second step, a parameter-dependent projection matrix is constructed which renders the dimension of the ROM independent of the number of geometry parameters. The proposed method features high rates of convergence, supports local adaptation, and yields ROMs that are of very low dimension and thus fast to evaluate. Finally, I will show how to preserve passivity, reciprocity, and causality during the order-reduction process.