From a finite element model to system level simulation by means of model reduction

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MUMPS Users Meeting 2010, Toulouse

In modern engineering there are two different types of simulation, finite element and system level. With the finite element method one can develop an accurate model at the device level. Yet the dimension of the finite element model is too high to employ it at the system level where the whole mechatronic system including many devices as well the control should be simulated. Model reduction allows us automatically to reduce the dimension of a finite element model [1] und thus reduce the time to prepare a compact behavioral model for system level model simulation. This will be illustrated by several praxis oriented examples with the use of software MOR for ANSYS.

A direct sparse solver is the important part of a model reduction algorithm, as here is usually necessary to solve a system of linear equations many times with the same matrix but different right hand sides. Hence the MUMPS solver [2] is the essential part of MOR for ANSYS and I will share my experience in this respect. Finally I will also share my experience with the commercialization of model reduction.

[1] E. B. Rudnyi and J. G. Korvink. "*Model Order Reduction for Large Scale Engineering Models Developed in ANSYS*." Lecture Notes in Computer Science, v. 3732, pp. 349-356, 2006.

[2] P. R. Amestoy, I. S. Duff, J. Koster and J.-Y. L'Excellent, "*A fully asynchronous multifrontal solver using distributed dynamic scheduling*", SIAM Journal of Matrix Analysis and Applications, v. 23, No 1, pp. 15-41, 2001.