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FRAUNHOFER INSTITUTE FOR INTEGRATED CIRCUITS IIS
DESIGN AUTOMATION DIVISION EAS

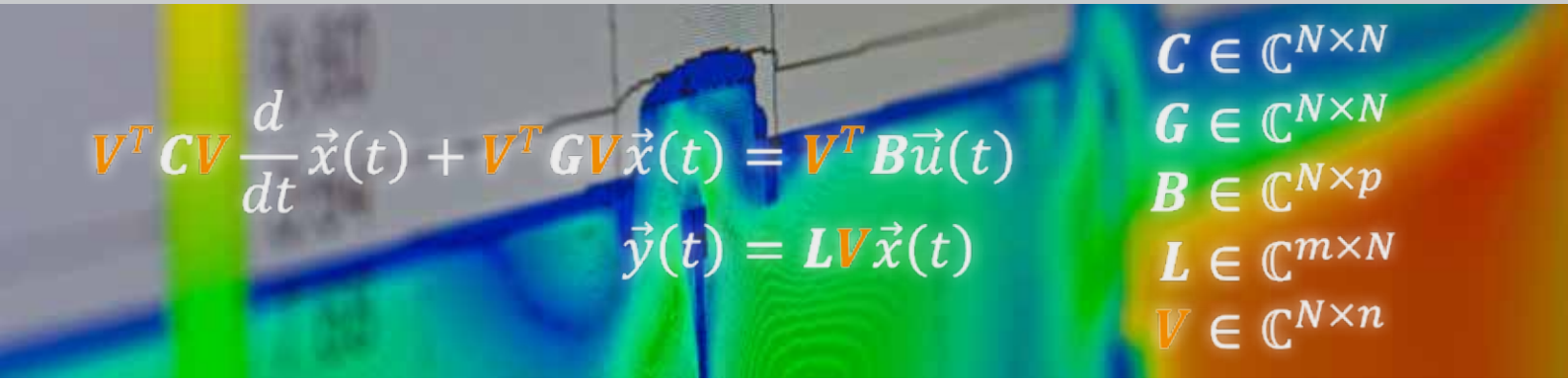


Photo: Jürgen Lösel

MODEL ORDER REDUCTION: A „PUSH BUTTON“ SOLUTION

Fraunhofer IIS/EAS offers its industrial partners and customers an individual service to adopt efficiently our model order reduction (MOR) methods. Customers benefit from years of experience in the field of model generation with MOR and become acquainted with the advantages of adaptive model order reduction developed by EAS.

Your Benefits

- Individual and adapted solutions suitable for automation
- Drastically reduced computation time for your simulation
- Handling of complex systems comprising more than one physical domain
- Use of reduced models for the co-simulation of heterogeneous systems
- Our long-standing experience in modeling and simulation

Our Services

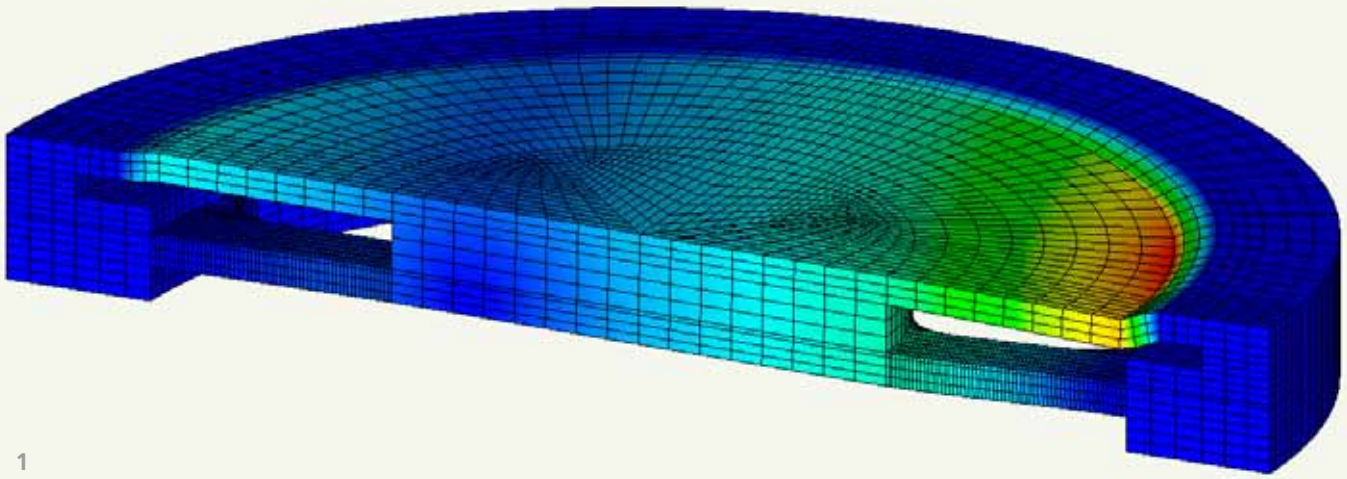
- Extraction of system matrices from commercial software tools (e.g., ANSYS, COMSOL) and development of exact and reduced behavioral models for established description languages (Matlab/Simulink, VHDL-AMS, Verilog-AMS, SystemC AMS, SPICE netlists, etc.)
- Customized generation of reduced models from mechanical or thermal finite element models of ANSYS and COMSOL
- Customer-specific tools for the integration of MOR into current workflows by adapted interfaces
- Support and advice on several problems in the context of model generation

Fraunhofer Institute for Integrated Circuits IIS
Design Automation Division EAS

Zeunerstraße 38
01069 Dresden, Germany

Contact:
Christian Bayer
Phone +49 351 4640-765
christian.bayer@eas.iis.fraunhofer.de

www.eas.iis.fraunhofer.de



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Fields of Application

Model order reduction techniques have particularly gained in importance in the fields of engineering, microsystems technology and microelectronics. MOR is especially used in the following areas of application:

- Static and dynamic problems concerning mechanics, heat conduction, electrical networks and electro-magnetic fields
- Heterogeneous systems: coupled simulation of different physical domains
- Parasitic effects in microelectronics, construction analysis, complex electrical transmission networks (power grids)
- Sensitivity analysis regarding irregularities in model parameters

Furthermore, the qualities of the system, for example stability and passivity, remain. Hence, the original model can be replaced seamlessly by a reduced model. This leads to a significant reduction of computation time. In addition, a coupling of reduced models with other simulators becomes feasible.

IIS/EAS has developed an adaptive MOR method, which stands out by usability and suitability for industry. The user does not have to deal with complex parameters but merely has to state the desired frequency range. Subsequently, the method automatically generates an appropriate reduced model. As a result MOR can be used as a part of automated model generation.

About Us

The Fraunhofer Institute for Integrated Circuits IIS performs contract research and development in the fields of microelectronic systems. The researchers of its Design Automation Division EAS in Dresden develop methods and tools for the reliable computer-aided design of complex electronic and mechatronic systems.

Since almost 10 years, the methods of model order reduction have been a key issue of Fraunhofer IIS/EAS. They are applied successfully in industrial and public projects.

1 *Simulated deformation of a position sensor with applied force*

What is MOR?

A typical problem of simulations of complex physical systems is the huge number of state space equations resulting from discretization, for example based on finite elements. The dimensions are typically of the order of 10^4 to 10^8. Therefore, the effort of system simulation in frequency or time domain is very high. Most users consider such a system as a "Black Box" with inputs and outputs, whereas the so-called inner states are not of particular interest. MOR is able to reduce the number of inner states drastically (to 10 to 1000) with negligible effect to the transmission behavior of the system.

Scheme of Model Order Reduction (MOR)