

Press release**Max-Planck-Institut für Dynamik komplexer technischer Systeme Magdeburg****Gabriele Ebel M.A.**

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<http://idw-online.de/en/news844011>Research results, Scientific Publications
Chemistry, Electrical engineering, Energy, Mathematics, Mechanical engineering
transregional, national**Model reduction: First textbook published by the Max Planck Institute Magdeburg**

With the publication of the textbook “Modellreduktion. Eine systemtheoretisch orientierte Einführung” in the Springer Studium Mathematik (Master) series, the first textbook in the history of the Max Planck Institute for Dynamics of Complex Technical Systems was released in 2024. The focus of the book is on systems theoretical methods, the development of which forms the essential core of the MPI's engineering research work and is applied here in the field of model reduction of dynamic systems.

The textbook “Model Reduction”, edited by the mathematicians Prof. Dr. Peter Benner, director at the Max Planck Institute Magdeburg and head of the Department of Numerical Methods in Systems and Control Theory, and Prof. Dr. Heike Faßbender, head of the Institute for Numerical Mathematics at the Technical University of Braunschweig, is a valuable resource for anyone interested in the research and application of scientific and technical models. The book addresses students and researchers of applied mathematics as well as computer-aided engineering and natural sciences, who wish to apply model reduction techniques in their fields of work. The methods are illustrated in a comprehensible way using numerical examples with applications from various fields of engineering.

In many areas of research and application, mathematical modelling and simulation are required to describe the behaviour of such complex systems. The exact description of the behaviour of complex physical systems often leads to very large systems, described by 10,000 or more equations. The direct simulation of these systems often demands an unacceptable amount of time, especially if the simulation has to be repeated several times for other input signals. Model reduction or model order reduction is a widely used and efficient tool for effectively solving complex physical problems. The aim of model order reduction is to simplify a large system using a much smaller model (known as a reduced-order model or ‘surrogate’) while retaining the essential physical properties with a greatly reduced calculation time, whereby the relevant variables can be determined without significant loss of accuracy with a greatly reduced calculation time.

This textbook introduces the model reduction of linear time-invariant systems with a consistent algorithmic orientation. It presents the necessary fundamentals from systems theory and numerical linear algebra and illustrates methods and concepts using numerical examples, including MATLAB.

Original publication:

Benner, P.; Faßbender, H.: Modellreduktion: Eine systemtheoretisch orientierte Einführung. Springer Spektrum, Berlin, Heidelberg (2024), XIV, 259 pp.

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