

## Model Reduction for Dynamical Systems

Model reduction, developed from well-established mathematical theories, robust numerical algorithms, and aided by machine learning, has been recognized as an efficient tool for fast simulation of large-scale systems arising from discretization of mathematical models for various engineering applications. This lecture will start with basic mathematical theories and numerical algorithms used in model reduction, and will continue introduce state-of-the-art model reduction methods applicable to problems ranging from simple to complex. During the lecture, the students are encouraged to interrupt and ask questions.

There are exercise courses associated with this lecture. During the exercise courses, the student are free to ask questions about the lecture as well as the exercises. The exercises include exercises on theoretical aspects and practical ones for which the students will have access to the data of some benchmark examples from engineering applications and will be able to test the learned methods and algorithms on those examples. We will present the performance of some methods on selected examples showing their accuracy and efficiency.

The exam is oral. The examination appointment can be made upon sending an email to the lecturer.

Target students:

Advanced Bachelor's students and Master's students in mathematics, computational science, computational engineering, modelling and simulation, and related. Upon request, master's theses on model reduction with applications in engineering problems may be assigned after taking the lecture.

The **starting time** of this lecture for the summer term 2025 is from the third week of April.