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Model reduction for PDEs – Benefits, chances, limitations and challenges

In many cases of practical interest, partial differential equations (PDEs) depend on parameters – one may think of coefficients, boundary conditions, material parameters or the geometry. Moreover, the PDE needs to be solved very often or in extremely short time for different parameter values. Such situations occur in optimization, uncertainty quantification (multi-query) or in situations where an approximate solution is needed extremely fast (realtime) or on devices with very limited capacity (embedded systems with low storage, CPU or energy demands).

In such situations, the reduced basis method (RBM) offers the chance to determine a reduced system in an offline training phase and then to solve the reduced system online extremely fast. Both training phase and online certification rely on a posteriori analysis, which provide (1) a reduced system with guaranteed accuracy and (2) a reduced online solution with a certified upper bound for the error.

In this talk, we will give an introduction into the RBM and show some applications where the RBM gives enormous speedup. We will also address the theoretical foundation leading to an understanding of chances and limitations of the RBM.

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15:30 – 16:30

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