MODEL ORDER REDUCTION – CHALLENGES IN engineering AND INDUSTRIAL APPLICATIONS

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ABSTRACT

Numerical simulations are essential in predicting the behavior of systems in many engineering fields and industry sectors. The development of accurate virtual representations of actual physical products or processes (also known as digital twins) allow huge savings in cost and resources by reducing the number of real, physical prototypes, tests, and experiments, thus also increasing the sustainability of production processes and the lifetime of products. For many complex engineering and industrial applications, standard methods still fall short in providing real-time, accurate simulations. There is, therefore, a great need for computationally efficient surrogate models (e.g. reduced order models, response surfaces, stochastic gaussian processes) that efficiently provide accurate solutions to the underlying complex models. The last two decades have thus shown considerable developments in the field of model reduction and its application to real-world problems. Nevertheless, many challenges remain.

This minisymposium aims to bring together researchers from diverse backgrounds to exchange ideas and initiate new lines of research with the aim of addressing the challenges hindering the efficient and robust use of surrogate modelling to enhance classical models in engineering and industrial applications. Particular focus is placed on addressing major challenges in model order reduction for complex problems and digital twinning applications, including (but not limited to):

* real-time response
* nonlinearities
* high-dimensional parameter spaces
* validation of the reduced models
* structure preservation
* coupled problems
* stochastic effects

on the application of model order reduction in optimization, control, inverse problems, optimal experimental design, and uncertainty quantification, as well as on exploring and understanding connections between model order reduction and machine learning.