# SEMINAR

## APPLIED MATHEMATICS AND MECHANICS

4 November 2019

A DCAMM seminar No. 747 will be presented by

**Jan S. Hesthaven**
**Professor of Mathematics**
**Chair of Computational Mathematics and Simulation Science**
**EPFL, Lausanne, Switzerland**

The title of the lecture is

**Non-intrusive reduced order models using Gaussian processes**

**Abstract:**

The development of reduced order models for complex applications, offering the promise for rapid and accurate evaluation of the output of complex models under parameterized variation, remains a very active research area. Applications are found in problems which require many evaluations, sampled over a potentially large parameter space, found in optimization, control, uncertainty quantification and applications where near real-time response is required.

However, many challenges remain to secure the flexibility, robustness, and efficiency needed for general large-scale applications, in particular for nonlinear and/or time-dependent problems.

After a brief introduction to projection based reduced order models, we discuss the use of data driven Gaussian process regression to enable the development of fast and accurate nonintrusive models for complex problems, including techniques for greedy regression/active learning and error estimation. We illustrate the performance by examples taken from nonlinear mechanics and fluid dynamics.

To enable the modelling of more complex problems, we discuss the development of hybrid element based reduced order model with local nonlinear elements, allowing for the rapid and fast evaluation of the response of large and complex structures with applications in design, uncertainty quantification, and risk assessment.

Time permitting we extend the discussion to the multi-fidelity case where different models are combined through co-kriging and the use of data driven techniques to enhance the predictive accuracy of the reduced models.

This work has been done with in collaboration with M. Guo (EPFL, CH), Z. Zhang (EPFL, CH), M. Kast (ETHZ, CH).

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| DATE: | **Monday, 18 November 2019** |
| TIME: | **15:00 – 15:45** |
| PLACE: | **Building 101 – meeting room 2 (Ly101-R3.143)** |
|  | DTU, Technical University of Denmark |

Danish pastry, coffee and tea will be served 15 minutes before the seminar starts.

All interested persons are invited.

Niels Leergaard Pedersen

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