IRTG 2657

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26 June 2024

1st International Symposium on modelling and efficient computation of high dimensional problems in computational mechanics
August 29th – 30th 2024
Leibnizhaus Hannover

Program Overview

Thursday, 29th August 2024

09:00 – 09:20 Arrival of all participants, welcome coffee

09:20 – 10:20 Contributed lectures part I

1. Ammar Airoud Basmaji
"Cyclic non-local anisotropic damage modelling of concrete meso-structure"

2. Ahsan Ali Siddiqui
"Real-time modeling of blood perfusion in liver lobules with high dimensional parameter spaces"

3. Jan Grashorn
"Efficient diagnostics of complex mechanical systems"

10:20 – 11:00 Invited lecture
Professor Peter Wriggers, Leibniz University Hannover
"Virtual elements for solids - an engineering perspective"
(For more details see appendix)

11:00 – 11:30 Coffee break

11:30 – 13:10 Contributed lectures part II

1. Marius Bittner
"Uncertainty quantification and efficient time-dependent reliability analysis of stochastic dynamic systems"

2. Fynn Bensel
"Non-intrusive reduced order models in biomedical applications"

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3. Wansheng Gao
"Non-intrusive reduced basis two-grid method for inverse modeling in heterogeneous porous media"

4. Marlis Reiber
"Efficient patient-specific modelling for the monitoring of hip implants"

5. Swami Subramaniyan Venkat
"Effect of pre-existing delamination defects on the evolution of buckling in composite laminates"

13:10 – 14:40 Lunch break

14:40 – 15:20 Invited lecture
Professor Jianbing Chen, Tongji University
"Global reliability based design optimization of complex structures subjected to earthquakes"
(For more details see appendix)

15:20 – 16:00 Invited lecture
Professor Francisco Chinesta,
Arts et Métiers Institute of Technology
"Physics Informed Digital Twins empowering the engineering of materials, processes, structures and systems"
(For more details see appendix)

16:00 – 16:30 Coffee break

16:30 – 17:30 Contributed lectures part III

1. Hendrik Geisler
"Uncertainty quantification for inelastic materials and structures: Time-separated stochastic mechanics"

2. Hendrik Fischer
"MORe DWR: Space-Time goal-oriented Error Control for incremental POD-based ROM"

3. Dr. Benjamin Hirzinger
"Frequency-based reliability analysis of large-scale high-dimensional uncertain structures"

19:00 Conference dinner at the restaurant „6Sinne Riverside"

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Friday, 30th August 2024

09:00 – 09:40 Invited lecture
Professor Olivier Allix, Université Paris-Saclay
"On the use of manifold learning using geometrical and topological descriptors for know-how based design optimisation"
(For more details see appendix)

09:40 – 10:20 Contributed lectures part IV

1. Viktor Kosin
"Dual-weighted residual goal-oriented error estimation for space-time adaptivity in phase-field fracture."

2. Dr. Zhibao Zheng
"Efficient numerical treatment of random inclusions in linear elasticity"

10:20 – 11:00 Coffee break

11:00 – 13:00 Poster Session

13:00 – 14:30 Lunch break

14:30 – 15:10 Invited lecture
Professor Peter Benner, MPI Magdeburg
"Learning Mechanical Systems from Data with Stability Certificates"

15:10 – 15:40 Coffee break

15:40 – 17:00 General Assembly IRTG2657

17:00 – 17:30 Farewell

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Appendix

Francisco Chinesta, Arts et Métiers Institute of Technology

„Physics Informed Digital Twins empowering the engineering of materials, processes, structures and systems“

This talk revisits advanced physics-based and data-driven technologies enabling the construction of digital twins, with special emphasis in the hybridation procédures. The resulting physics informed digital twins will be applied to different domains of engineering, in particular materials, processes, structures and systems, proving their versatility and ability to address new engineering challenges.

Olivier Allix, Université Paris-Saclay

„On the use of manifold learning using geometrical and topological descriptors for know-how-based design optimization“

Industrial know-how is often difficult to be synthesised in a set of rules or steps and remain therefore implicit. We propose using existing Machine Learning tools to infer, in the form of a "reduced manifold", the know-how from an existing limited set of designs. For this a distance, mixing topology and geometry is proposed. On simple 2D examples, it allows obtaining a proper clusturing and dimensionnal reduction. The interpolation and the optimization within the constructed manifold relying on optimal transport.

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25 July 2024

Jianbing Cheng, Tongji University

„Global reliability based design optimization of complex structures subjected to earthquakes“

Design optimization of structures is a rational approach to achieve trade-off between safety and economic efficiency and other performances. However, uncertainties are involved in both structural parameters and external excitations, e.g. earthquakes, consequently in the design optimization of complex structures the uncertainties have to be rationally taken into account, say, by guaranteeing the global reliability of the structure. In the present lecture, the quantification of uncertainty and spatial variability of structural parameters, the high-efficient reliability evaluation by the probability density evolution equation, and the functional perspective based global sensitivity for design optimization will be delineated. Examples will be shown to illustrate the necessity and feasibility of the global reliability based design optimization of complex structures. Problems to be further studied will also be discussed.

Peter Wriggers, Leibniz University of Hannover

„Virtual elements for solids - an engineering perspective“

The Virtual Element Method (VEM) is a novel technology for the approximate solution of partial differential equations that shares the variational background of the finite element method. VEM has the flexibility to deal with general polygonal/polyhedral meshes, including “hanging vertices” and non-convex element shape, while retaining the conformity of the method.
VEM has some advantages for different applications in the area of engineering which include:

- Homogenization of materials with polycrystalline microstructure,
- C1-continuous formulation of plate and shell elements
- Contact problems with matching meshes,
- Fracturing of brittle solids and
- Discrete flexible elements

The lecture discusses pro and cons of the virtual element method including specific approaches for the numerical discretization of solids.

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