UNIVERSITÀ DEGLI STUDI DI BERGAMO | Scuola di Ingegneria

Full and Reduced Order Modelling for Digital Twinning with Applications to Damage Detection

Dr. Konstantinos AGATHOS

Department of Civil, Environmental and Geomatic Engineering, ETH Zurich

E-mail: agathos@ibk.baug.ethz.ch

Invited Lecturer within the course of Computational Mechanics of Solids and Structures

University of Bergamo
School of Engineering, viale G. Marconi 5, Dalmine (BG)

June 12, 2020, 3:00 pm - 4:00 pm (Italian local time)

The link to attend the webinar (on Microsoft Teams platform) is **here**

ABSTRACT

In the last decades, advances in digital technologies have led to an enormous increase in both the computational power and the flexibility offered by the available computing systems. In the field of computational mechanics, this is reflected by the development of a variety of methods aiming at different target applications and computer architectures. Such applications can range from parallel methods for nonlinear multi physics problems, typically aimed at clusters with thousands of nodes, to reduced order models (ROMs) with a few tens of unknowns that can be run in mobile devices. More recently, and partly due to the increasing use of data and data driven methods in engineering, the assimilation of data into numerical models, in close relation to the concept of digital twinning, has emerged as a new challenge. From the modelling point of view, parametric reduced order models (pROMs) possess some very attractive features that can greatly facilitate this process. More specifically, they offer comparable accuracy to high fidelity models at a fraction of their numerical cost and, through parametrization, they can be adapted to reflect different states of real life systems.

This presentation will aim at illustrating a possible realization of a digital twin through the development of pROMs for cracked solids and shells and their application to crack detection problems. Regarding the interaction of the developed pROMs with measurement data, two alternatives will be presented. The first combines ROMs with more traditional structural health monitoring (SHM) tools, such as damage indices, in order to detect cracks in shell structures, in the absence of information regarding the applied loading. The second approach employs particle filters to estimate both the loading and the response of the system in an online fashion, based on available measurements. At a second level, parameters of the model are also estimated, leading to the detection of damage.

Dr. Konstantinos AGATHOS studied civil engineering at the Aristotle University of Thessaloniki (2009), where he also obtained his PhD (2015). He continued his research as a Post Doc at the University of Luxembourg (2015-2017) supported by Prof. Dr. Stéphane Bordas. In April 2017 he joined the Chair of Structural Mechanics at ETH. His research focuses on the simulation of fracture using the eXtended Finite Element Method (XFEM) with applications to crack propagation and crack detection problems.

Ref. Dr. Rosalba Ferrari, rosalba.ferrari@unibg.it, http://www.unibg.it/pers/?rosalba.ferrari