UNIVERSITY OF TRENTO

XP-resilience

EXTREME LOADING ANALYSIS OF PETROCHEMICAL PLANTS AND DESIGN OF METAMATERIAL-BASED SHIELDS FOR ENHANCED RESILIENCE

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SEMINAR ANNOUNCEMENT

The following seminar will be organised on 13.01.2020 at 16.30 in room 2R

Recent Ideas and Developments in Systems Modelling Using Big Data

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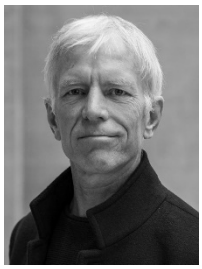
Abstract:

The probabilistic representation of systems performances is a challenging but crucially important task in the context of engineering decision making. Across different engineering application areas a large variety of different probabilistic approaches for the representation of systems performances have been developed, all aiming to provide information consistent models of the systems performances, which govern the ranking of decisions for their design and management. In many cases the considered systems are rather complex and may e.g. comprise interconnected systems subject to uncertainties represented by high dimensional vectors of causally and stochastically dependent random variables. Moreover, the considered systems may in general exhibit significant nonlinear characteristics at different scales between demands acting on and within the systems and their performances. The output of analyses, based on the available probabilistic models, typically center around a relatively few key characteristics, such as the annual probabilities of complete or partial system failure, and various types of systems damage events. This type of output may be seen to comprise the key information with respect to what ultimately drives the expected values of consequences associated with the performances of the systems. However, such relatively sparse extracts of information offer very little, if any, information and/or knowledge with respect to the characteristics of the event scenarios of the physical processes, which lead to different states of failures and damages. The immediate results of probabilistic systems analyses therefore do not provide much insight on whether the developed and analyzed models behave physically meaningful, how uncertainties associated with the probabilistic modeling affect the probabilistic characteristics of systems performances, and how the systems performances may efficiently be improved by changing the physical characteristics of the system, or by improving the knowledge about the system.

In the present contribution the potentials of utilizing techniques of big data analysis as a means to improve the understanding of complex probabilistic system representations are investigated. It is assumed that a probabilistic model is available for the representation of the system performances, and that an adequate Monte Carlo simulation technique is available and applied for the probabilistic analysis of these. Model-based clustering analysis is then applied to establish a visual representation of the Monte Carlo simulated scenarios of events leading to different performances of the considered system. Various conditioning events on the simulated scenarios, such as specific failure events, are readily introduced by sorting. Assuming that the Monte Carlo simulated scenarios of events are utilized to establish a surrogate representation of the considered system, variance based sensitivities are derived for both the case of independent and dependent random variables.

The proposed scheme is illustrated on a simple example in which the probabilistic characteristics of non-linear structural performances of a moment resisting frame structure are considered.

Short Biography:



Michael Havbro Faber is Professor in the area of Risk Informed Decision Support for Structures at the Department of Civil Engineering at Aalborg University, Denmark.
His research interests include on decision theory, risk assessment, resilience, sustainability, global catastrophic risks, uncertainty modeling, life safety management, Bayesian probability theory and applied statistics.

The seminar is organised by the XP-RESILIENCE research group
http://r.unitn.it/en/dicam/xp-resilience
Prof. Oreste S. Bursi

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