ΑΝΑΚΟΙΝΩΣΗ - ΠΡΟΣΚΛΗΣΗ
ΔΗΜΟΣΙΑ ΥΠΟΣΤΗΡΙΞΗ ΔΙΔΑΚΤΟΡΙΚΗΣ ΔΙΑΤΡΙΒΗΣ

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Προσκαλούμε τους μεταπτυχιακούς και προπτυχιακούς φοιτητές μας, τα μέλη Δ.Ε.Π., και κάθε ενδιαφερόμενο, στη δημόσια υποστήριξη της Διδακτορικής Διατριβής της κ. Tulay Ercan με τίτλο:

BAYESIAN OPTIMAL EXPERIMENTAL DESIGN TOOLS

In structural dynamics, optimal experimental design (OED) aims to maximize the information gained from data by optimizing the location, type, and number of sensors and actuators as well as the excitation characteristics. In this thesis, a Bayesian OED framework is presented for (a) virtual sensing and (b) parameter estimation, to support the decision-making processes regarding structural health, safety, and performance. The OED framework utilizes information theoretic-based measures to build a utility function robust to measurement, modeling and input uncertainties. The information contained in the data collected from a sensor configuration is defined as the Kullback-Leibler divergence between the prior and posterior distribution of the model parameters or the predicted response quantities of interest, estimated using Bayesian inference. The resulting multidimensional integrals over the prior distribution of the model and nuisance parameters are estimated by using asymptotic approximations, as well as Monte Carlo and/or sparse grid techniques. The optimization of the utility function is performed using Genetic Algorithms and heuristic forward and backward sequential sensor placement (SSP) algorithms. The computational effort and accuracy of the optimization algorithms are investigated and a new computationally efficient and accurate SSP algorithm is proposed.

The optimal sensor placement (OSP) framework for virtual sensing is developed based on modal expansion and Kalman-based input-state estimation techniques. The framework is applicable to response and/or input time history reconstruction over the structure given output-only vibration measurements. The advantages and limitations of each technique for response and input reconstruction as well as their potential for fusing different types of vibration sensors are investigated. The effect of the measurement and model/prediction errors and their uncertainties, as well as the input uncertainties on the optimal sensor configuration is thoroughly studied, highlighting the importance of accounting for robustness to errors and other uncertainties.

A Bayesian OED framework for reliable parameter estimation of nonlinear models of structures using input-output response time history measurements is also developed, accounting for the modelling and input uncertainties. Asymptotic approximations, valid for large number of data, are developed to provide valuable insight into the information provided from the data and the effect of prior distribution. Robustness of OSP to nuisance parameters related to modeling and input uncertainties is investigated. Stochastic models used to simulate the random variability of the excitation time histories and characteristics are incorporated into the framework to optimally design sensor configurations, robust to unknown input variability. The applicability and effectiveness of the method is demonstrated for structures with restoring forces exhibiting hysteretic nonlinearities.

The effectiveness of the OED framework for virtual sensing is finally demonstrated with artificial and real measurements using full-scale components of engineering structures, including a wind turbine blade and a helicopter blade tested at a laboratory environment.

Δευτέρα 27 Ιουνίου 2022, ώρα 10:00
Η live μετάδοση της παρουσίασης θα γίνει στον ακόλουθο σύνδεσμο:
https://diavlos.grnet.gr/epresence-conference-12381