The 14th International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE2024)

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Special Session on:

Machine Learning-Assisted Uncertainty Quantification for Engineering Structures

Engineering structures are inherently susceptible to a multitude of uncertainties, ranging from geometric variations to external stochastic loads. These uncertainties wield significant influence over structural performance and, in severe cases, can lead to structural failure. Thus, structural uncertainty quantification, which encompasses uncertainty modeling and simulation, uncertainty propagation, reliability analysis, sensitivity analysis, reliability-based design optimization, robust-based design optimization, and more, holds paramount engineering significance. However, effectively quantifying uncertainties in complex engineering structures remains a daunting task, particularly when dealing with strongly nonlinear and high-dimensional problems.

Recently, machine learning techniques such as Gaussian processes, polynomial chaos expansion, artificial neural networks, Bayesian neural networks, among others, have emerged as powerful tools in addressing intricate engineering challenges. This special session invites contributions that explore the developments of structural uncertainty quantification leveraging various machine learning techniques. The scope of potential topics is broad and includes machine learning-assisted models and methodologies tailored for strongly nonlinear and high-dimensional structures. Additionally, emphasis will be placed on handling multiple sources of uncertainties, time-independent and time-dependent structures, as well as scenarios involving small failure probabilities, all through the lens of machine learning techniques.

We welcome contributions that tackle real-world challenges and present machine learning theories within disciplines such as civil engineering, aerospace engineering, construction engineering, mechanical engineering, automobile engineering, and related fields.


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