8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMA2022)
June 5-9, 2022, Oslo, Norway

BAYESIAN INFERENCE OF ENGINEERING MODELS: ADVANCES IN THEORY AND APPLICATIONS

TRACK NUMBER: 5000-SCIENTIFIC COMPUTING

OINDRILA KANJILAL[*], IASON PAPAIOANNOU[*], DANIEL STRAUB[*],

GEERT LOMBAERT[†], COSTAS PAPADIMITRIOU[+]

[*] Engineering Risk Analysis Group, TU Munich
Theresienstrasse 90, 80333 Munich, Germany
oindrila.kanjilal@tum.de, iason.papaioannou@tum.de, straub@tum.de

[†] Department of Civil Engineering, KU Leuven
Kasteelpark Arenberg 40, 3001 Leuven, Belgium
geert.lombaert@kuleuven.be

[+] Department of Mechanical Engineering, University of Thessaly
Leoforos Athinon, Pedion Areos, 38334 Volos, Greece
costasp@uth.gr

Key words: Bayesian inference, computational models, reliability updating, sampling-based inference, machine learning

ABSTRACT

Computational models are widely used in science and engineering to predict the response of complex physical and mechanical systems. The parameters of these models often cannot be determined uniquely as they are affected by uncertainties. Bayesian inference provides a powerful tool for making statistical inference of the uncertain model parameters by use of data and other available information. The methods for Bayesian inference most commonly rely on sampling algorithms to explore the outcome space of the uncertain parameters. For problems in which evaluation of the computational model is costly, such exploration can require enormous computational efforts. Hence, recent research focuses on the development of efficient Bayesian inference methods based on novel mathematical formulations or advanced sampling techniques. In this mini-symposium, we look for contributions that address either methodological developments or novel applications on Bayesian inference of computational models of engineering systems. In this respect, topics of interest include, but are not limited to, the following: advanced sampling methods for Bayesian analysis, inference in the presence of spatial/temporal dependence of uncertainty, structural identification, recursive Bayesian inference, virtual sensing, hierarchical Bayesian models, optimal experimental design, Bayesian reliability updating, Bayesian inference with surrogate models, accelerated Bayesian inference using machine leaning and high performance computing.