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Modern Methods of Quantifying Parameter Uncertainties via Bayesian Inference

Wednesday, 15 September 2021 16:00 (30 minutes)

In modern metrology an exact specification of unknown characteristic values, such as shape parameters or material constants, is often not possible due to e.g. the ever decreasing size of the objects under investigation. Using non-destructive measurements and inverse problems is both an elegant and economical way to obtain the desired information while also providing the possibility to determine uncertainties of the reconstructed parameter values. In this talk we present state-of-the-art approaches to quantify these parameter uncertainties by Bayesian inference. Among others, we discuss surrogate approximations for high-dimensional problems to circumvent computationally demanding physical models, error correction via the introduction of an additional model error to automatically correct systematic model discrepancies and transport of measure approaches using invertible neural networks which accelerate sampling from the problem posterior drastically in comparison to standard MCMC strategies. The presented methods are illustrated by applications in optical shape reconstruction of nano-structures, in particular photo-lithography masks, with scattering and grazing incidence X-ray fluorescence measurements.

Keywords

inverse problems, uncertainty quantification, Bayesian inference, surrogate model, measure transport, invertible neural networks

Special/invited session

SIG Measurement Uncertainty

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