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QMC Opening Workshop
August 28-September 1, 2017

Lecture: *Bayesian Probabilistic Numerical Methods (Part II)*

Speaker: Tim Sullivan

Abstract:

(This is the second part of joint talk with Chris Oates. Time permitting, the two talks will address the theoretical and computational aspects respectively.)

In this work, numerical computation - such as numerical solution of a PDE - is treated as an inverse problem in its own right. The popular Bayesian approach to inversion is considered, wherein a posterior distribution is induced over the object of interest by conditioning a prior distribution on the same finite information that would be used in a classical numerical method. The main technical consideration is that the data in this context are non-random and thus the standard Bayes' theorem does not hold. General conditions will be presented under which such Bayesian probabilistic numerical methods are well-posed, and a sequential Monte-Carlo method will be shown to provide consistent estimation of the posterior. The paradigm is extended to computational ``pipelines", through which a distributional quantification of numerical error can be propagated. A sufficient condition is presented for when such propagation can be endowed with a globally coherent Bayesian interpretation, based on a novel class of probabilistic graphical models designed to represent a computational work-flow. The concepts are illustrated through explicit numerical experiments involving both linear and non-linear PDE models. Full details are available in arXiv:1702.03673.