Uncertainty quantification with Non-Gaussian Correlated Process Variations: Theory, Algorithms and Applications

Abstract:

Since the invention of generalized polynomial chaos in 2002, uncertainty quantification has impacted many engineering fields. However, almost all existing generalized polynomial chaos methods have a strong assumption: the uncertain parameters are mutually independent or Gaussian correlated. This assumption rarely holds in many realistic applications, and it has been a long-standing challenge for both theorists and practitioners. In this talk, I will present two algorithms for handling this task. The first one is stochastic collocation algorithm, and the second one is sparse optimization approach. We provide some rigorous proofs for the complexity and error bound of our proposed method. Numerical experiments on synthetic, electronic and photonic integrated circuit examples show the nearly exponential convergence rate and excellent efficiency of our proposed approaches. This is a joint work with Prof. Zheng Zhang from UC Santa Barbara.