Simulation-based, high-dimensional stochastic optimization: application in robust topology optimization under large material uncertainties

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Abstract: This talk is concerned with the optimization/design/control of complex systems characterized by high-dimensional uncertainties and design variables. While analogous problems in a deterministic setting, and particularly in the context of PDE-based models, have been extensively studied and several algorithmic tools have been developed, their extension to stochastic settings poses several challenges. We discuss two alternative strategies. The first is based on stochastic approximation tools [1]. We discuss Variational Bayesian approximations that enable the estimation of gradients in a manner that reduces the sampling noise and the computational effort. The second approach reformulates the problems as one of probabilistic inference [2] and employs sampling tools suitable for high-dimensions [3, 4]. We are especially concerned with problems relating to random heterogeneous materials where uncertainties arise from the stochastic variability of their properties.

References

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