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Multi-fidelity uncertainty quantification in large-scale predictive simulations of turbulent flow[1] GIANLUCA GERACI, Sandia National Laboratories, LLUIS JOFRE-CRUANYES, GIANLUCA IACCARINO, Stanford University — The performance characterization of complex engineering systems often relies on accurate, but computationally intensive numerical simulations. It is also well recognized that in order to obtain a reliable numerical prediction the propagation of uncertainties needs to be included. Therefore, Uncertainty Quantification (UQ) plays a fundamental role in building confidence in predictive science. Despite the great improvement in recent years, even the more advanced UQ algorithms are still limited to fairly simplified applications and only moderate parameter dimensionality. Moreover, in the case of extremely large dimensionality, sampling methods, i.e. Monte Carlo (MC) based approaches, appear to be the only viable alternative. In this talk we describe and compare a family of approaches which aim to accelerate the convergence of standard MC simulations. These methods are based on hierarchies of generalized numerical resolutions (multi-level) or model fidelities (multi-fidelity), and attempt to leverage the correlation between Low- and High-Fidelity (HF) models to obtain a more accurate statistical estimator without introducing additional HF realizations. The performance of these methods are assessed on an irradiated particle laden turbulent flow (PSAAP II solar energy receiver).

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