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Simulation of stochastic quantum systems using polynomial chaos expansions KEVIN YOUNG, MATTHEW GRACE, Sandia National Laboratories — We present an approach to the simulation of quantum systems driven by classical stochastic processes that is based on the polynomial chaos expansion, a well-known technique in the field of uncertainty quantification. The polynomial chaos expansion represents the system density matrix as a series of orthogonal polynomials in the principle components of the stochastic process and yields a sparsely coupled hierarchy of linear differential equations. We provide practical heuristics for truncating this expansion based on results from time-dependent perturbation theory and demonstrate, via an experimentally relevant one-qubit numerical example, that our technique can be significantly more computationally efficient than Monte Carlo simulation.

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