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Regression-based adaptive sparse polynomial dimensional decomposition for sensitivity analysis KUNKUN TANG, PIETRO CONGEDO, Inria, REMI ABGRALL, Universität Zürich — Polynomial dimensional decomposition (PDD) is employed in this work for global sensitivity analysis and uncertainty quantification of stochastic systems subject to a large number of random input variables. Due to the intimate structure between PDD and Analysis-of-Variance, PDD is able to provide simpler and more direct evaluation of the Sobol' sensitivity indices, when compared to polynomial chaos (PC). Unfortunately, the number of PDD terms grows exponentially with respect to the size of the input random vector, which makes the computational cost of the standard method unaffordable for real engineering applications. In order to address this problem of curse of dimensionality, this work proposes a variance-based adaptive strategy aiming to build a cheap meta-model by sparse-PDD with PDD coefficients computed by regression. During this adaptive procedure, the model representation by PDD only contains few terms, so that the cost to resolve repeatedly the linear system of the least-square regression problem is negligible. The size of the final sparse-PDD representation is much smaller than the full PDD, since only significant terms are eventually retained. Consequently, a much less number of calls to the deterministic model is required to compute the final PDD coefficients.

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