## Model Order Reduction for Parametric High Dimensional Models in the Analysis of Financial Risk

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The risk analysis of financial instruments often requires the valuation of such instruments under a wide range of future market scenarios, demanding efficient algorithms. Thus, we establish a parametric model order reduction approach based on a variant of the proper orthogonal decomposition. The method generates small model approximations for the high dimensional parametric convection-diffusion-reaction partial differential equations that arise in financial risk analysis. This approach requires solving the full model at some selected parameter values to generate a reduced basis. We propose an adaptive greedy sampling technique based on surrogate modeling for the selection of this sample parameter set. The new technique is analyzed, implemented, and tested on industrial data of different financial instruments under short-rate models. The results illustrate that the reduced model approach works well and shows potential applications in historical or Monte Carlo value at risk calculations.

**Keywords:** Financial risk analysis; convection-diffusion-reaction equation; parametric model order reduction; proper orthogonal decomposition; adaptive greedy sampling; packaged retail investment and insurance-based products