

A Meta-model-based Importance Sampling for Reliability-based Design Optimization

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Abstract

Reliability-based design optimization (RBDO) is an appropriate design optimization method considering the uncertainties. Accuracy and efficiency are two important issues. In this research, polynomial chaos expansion (PCE) meta-model is used to approximate the expensive computational model (e.g. a finite element model). The probability of failure is computed through importance sampling which selects sample from a larger stationary sample set. By using the new importance sampling, the method can not only calculate the accurate failure probabilities, but also avoid a large number of model estimations as it only needs one simulation run during the optimum design process. Thus, the trade-off of accuracy and efficiency of RBDO can be obtained for high nonlinear limit-state function and time-consuming model.

Keywords: Reliability-based design optimization, Importance sampling, Meta-model