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Efficient rare event simulation for failure problems in random media.

Summary: In this paper we study rare events associated to the solutions of an elliptic partial differential equation with a spatially varying random coefficient. The random coefficient follows the lognormal distribution, which is determined by a Gaussian process. This model is employed to study the failure problem of elastic materials in random media in which the failure is characterized by the criterion that the strain field exceeds a high threshold. We propose an efficient importance sampling scheme to compute the small failure probability in the high threshold limit. The change of measure in our scheme is parametrized by two density functions. The efficiency of the importance sampling scheme is validated by numerical examples.

Keywords: random media; rare event; importance sampling; Gaussian random function
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