PROBABILITY SENSITIVITY ANALYSIS APPLYING LINE SAMPLING

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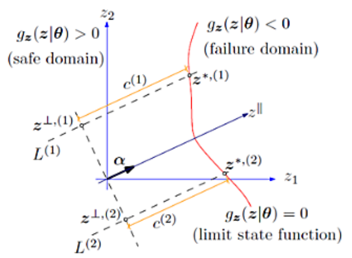

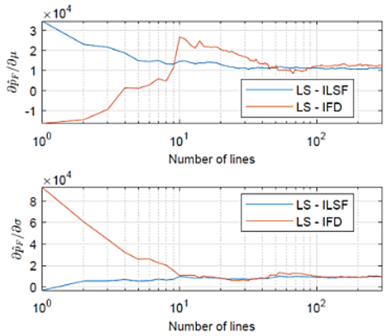

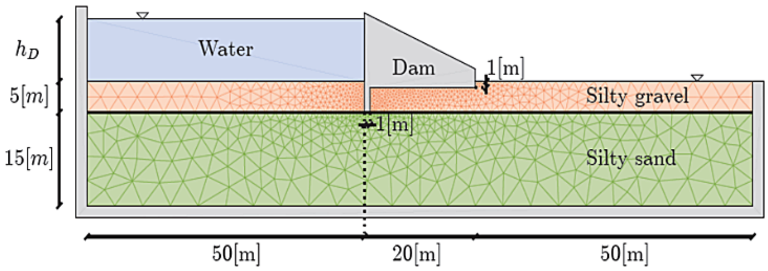

Probability theory offers the means for quantifying the effects of uncertainty on the performance of engineering systems. Thus, the system's safety can be expressed in terms of, e.g. a failure probability. It is noted that the failure probability associated with a system depends on the selection of parameters that define a probability distribution (such as mean or variance). Hence, it is of interest assessing the sensitivity of the failure probability with respect to parameters of a probability distribution. Such information allows pinpointing the parameters that influence the most the failure probability and can be most useful in context with, e.g. reliability-based or robust design optimization. A possible means for evaluating such sensitivity is calculating the partial derivative of the failure probability with respect to different parameters of the probability distributions that characterize the uncertainty of the problem.

Different contributions in the literature have shown that the gradient of the failure probability with respect to distribution parameters can be calculated in a post-processing step of a standard reliability analysis. That is, the sought sensitivity becomes a byproduct of a reliability analysis. In this context, this contribution explores the possibility of calculating the probability gradient applying Line Sampling. It is shown that the sought sensitivity can be calculated by two different approaches, which involve either a surface integral or a volume integral. The application of the proposed approach is investigated for problems involving random variables as well as random fields. Moreover, the possibility of aggregating the two approaches for probability sensitivity into one combined optimal estimator is reviewed as well.

Guests are welcome!

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