

## Sensitivity of Stochastic Model Updating tools including Staircase Random Variables using different Cost Functions

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Monitoring processes have become an increasingly important aspect in the management of structural dynamical systems over their lifetime. In this regard, stochastic model updating techniques allow quantifying and reducing the discrepancy between numerical model predictions and available measurement data <sup>1</sup>. To address situations in which the model parameter uncertainties are explicitly described in a hybrid form, a two-stage approximate Bayesian computation approach that includes stochastic distance metrics and staircase random variables (SRVs) <sup>2</sup> has been recently proposed <sup>3</sup>. Specifically, this framework assumes the model predictions as SRVs. For a given value of the updating parameters, the SRV distributions are determined by simulating realizations of the model predictions followed by the solution of an appropriate optimization problem. The resulting distribution is employed to quantify the resemblance between measurements and model predictions through the Euclidian and Bhattacharyya distances <sup>4</sup>. In general, this approach provides significant flexibility and generality to identification procedures in terms of the possible shapes for model prediction distributions. While several cost functions have been proposed to determine SRV distribution, their effect on stochastic model updating results has not been evaluated yet. In this regard, the present contribution aims to assess the impact of choosing alternative formulations to determine SRV distributions on the two-stage approach performance. To illustrate the advantages and limitations of the different formulations, two examples are presented. These include a two-degree-of-freedom model and the NASA UQ challenge problem. Numerical results suggest that the use of SRV constitutes a robust and efficacious strategy to address a class of model updating problems involving hybrid uncertainties.

**Keywords:** Bayesian Model Updating, Bhattacharyya distance, Approximate Bayesian Computation, Staircase Random Variable.

### References

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