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UQ WITH DEPENDENT INPUTS: WIND AND WAVES

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Uncertainty in wind and wave conditions during the turbine life is one of the reasons for the high costs of offshore wind farms. Especially the dependencies between the uncertainties can lead to high turbine loads, for example during a storm. It is therefore of high importance to have uncertainty quantification (UQ) methods available that can deal with these dependencies, for uncertainty propagation as well as for sensitivity analysis (SA).

The development of these methods comes with three different problems. First, they need to be able to handle dependencies. Second, input uncertainties will be available as a large dataset rather than a distribution, and finally, the allowed number of output samples is limited because of the high cost of the corresponding CFD simulations.

We will present methods for both UQ and SA which are specifically designed for dependent uncertain inputs, specified through datasets. Clustering methods are used to select the input samples [1], while the Rényi entropy, computed by minimum spanning trees (MSTs), is used for sensitivity analysis [2].

To demonstrate these methods, a testcase is presented in which the distribution of the power output of a wind turbine is estimated from a dataset containing weather conditions.

REFERENCES

[1] A. W. Eggels, D. T. Crommelin, and J. A. S. Witteveen, *Clustering-based collocation for uncertainty propagation with multivariate dependent inputs*, to appear in International Journal for Uncertainty Quantification, 2018.

[2] A. W. Eggels, and D. T. Crommelin, *Quantifying dependencies for sensitivity analysis with multivariate input sample data*, submitted, 2017.