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COMPARING TWO MULTI-FIDELITY METHODS FOR FORWARD UNCERTAINTY QUANTIFICATION OF SHIP RESISTANCE

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In this talk we present a comparison of two methods for the forward Uncertainty Quantification (UQ) analysis of a passengers ferry advancing in calm water and subject to two operational uncertainties, namely ship speed and payload. Specifically, the performance of Multi-Index Stochastic Collocation (MISC) and multi-fidelity Stochastic Radial Basis Functions (SRBF) surrogates is assessed. The estimation of the expected value of the (model-scale) resistance to advancement, as well as of its higher order moments and probability density function, are presented and discussed. Both methods need to repeatedly solve the free-surface Navier-Stokes equations for different configurations of the operational parameters. The required CFD simulations are obtained by a multi-grid Reynolds Averaged Navier–Stokes (RANS) equations solver. Both MISC and SRBF use as fidelity levels the intermediate grids employed by the RANS solver. A relevant aspect for the comparison of the two methods is that the CFD simulations are affected by numerical noise, which is due to the iterative algorithm on which the solver is based. In particular, we discuss the impact of the noise on the forward UQ analysis and investigate some strategies to improve the performance of the two methods with respect to this issue.

REFERENCES

[1] C. Piazzola, L. Tamellini, R. Pellegrini, R. Broglia, A. Serani, and M. Diez, Comparing Multi-Index Stochastic Collocation and Multi-Fidelity Stochastic Radial Basis Functions for Forward Uncertainty Quantification of Ship Resistance. *In revision*, 2021.