Uncertainty Quantification of the DTMB 5415 Performance Subject to Geometrical and Operational Uncertainties via Multi Index Stochastic Collocation

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ABSTRACT

In the design of marine/ocean vessels, the uncertainty associated with the operational conditions and the design variables is a need-to-know information to achieve robust design configurations. The increase of the available computational power (*e.g.*, High Performance Computer, HPC) allows to use, with a high computational cost, high-accuracy physics-based solvers to obtain accurate predictions of innovative designs in extreme operating conditions. However, such technological improvement faces two main limitations: i) the number of designs and/or conditions that can be investigated is limited by the high computational cost; ii) HPC systems are not available to most of the designers. To overcome such limitations, multi-fidelity (MF) approaches can be used to reduce the number of high-accuracy simulations required to perform uncertainty quantification (UQ) of the design affected by operational and/or geometrical uncertainty. Specifically, MF approaches allow to efficiently and effectively combine solvers with different accuracies to reduce the overall cost of the UQ process. This is usually performed combining few high-accuracy and costly simulations with many low-accuracy and cheap to run simulations.
The objective of this work is the investigation of the performance of the MF method Multi-Index Stochastic Collocation (MISC) [1] when applied to the UQ of the performance of the DTMB 5415. Operational (*e.g.,* Froude number) and geometrical variables (*e.g.*, hull shape) uncertainties are considered. The simulations are performed with the in-house linear potential flow solver WARP [2]. A comparison of MISC against its single-fidelity counterpart (Sparse Grids Stochastic Collocation) will be provided and discussed.

REFERENCES

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