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SHOPROMs: SHip Optimization with Reduced Order Methods

The SHOPROMs project aims to integrate new optimization techniques in the structural design process of passenger cruise ships.

Many sections of the ship hull are parameterized by their thickness, with the structural behaviour of the configuration being subjected to complex regulatory and industrial constraints.

From simulations run with a commercial solver, reduced order surrogates are built using non-intrusive Proper Orthogonal Decomposition with Interpolation. A novel multi-fidelity approach exploiting parameter space reduction through Active Subspaces proves effective in terms of prediction error. Then, iteratively, a Bayesian Optimization step selects new designs to be processed by the commercial solver, thus enabling new and more precise surrogates.

The resulting pipeline has been tested on a simplified model of a midship section and on the full model of a passenger cruise ship, with different parameterizations up to 40 parameters. In both cases, the framework proved fast and effective in finding good designs.

SHOPROMs is carried out in the context of the IRISS initiative by SMACT, with Fincantieri S.p.A. as industrial partner.

References

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