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Reduced order models for the solution of geometrically-parametrised turbulent flow problems.

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The solution of flow problems in industrial applications often results in large systems, further exaggerated in the case of parametrised problems. Such problems can prove cumbersome to conventional, or high-fidelity, techniques. However, reduced order models (ROM) offer an efficient alternative, greatly reducing the computational complexity of the underlying problem. This work explores the applicability of a hybrid ROM strategy for the solution of geometrically-parametrised flow problems in an industrially-relevant setting, paying close attention to the handling of the geometric parametrisation contributions in the online phase.

The methodology combines data-driven and projection-based techniques. The reduced basis is constructed by means of the proper orthogonal decomposition (POD), and the Galerkin projection of the Navier-Stokes problem for the evaluation of the parametric coefficients. On the other hand, the eddy viscosity, and in effect the turbulent contribution is approximated via an interpolation scheme, i.e. POD-I, significantly improving the versatility of the methodology.

Finally, the capabilities of the proposed strategy are tested by approximating the turbulent flow around a NACA aerofoil with parametrised angle of attack, expanding the work presented in [1] to turbulent problems.

REFERENCES

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