Coupling of geometric design and simulation in a proper generalised decomposition framework

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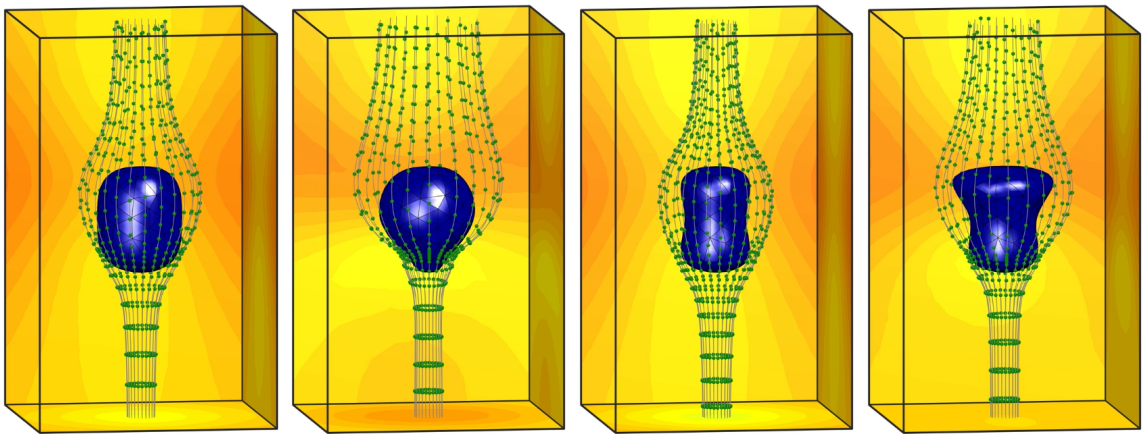
ABSTRACT

The ability to predict, and ultimately optimise, aerodynamic forces when the design variable is the geometric definition of the domain is of great importance in many areas of computational fluid dynamics. This problem is known to be extremely computationally intensive due to the vast number of configurations that must be tested and the high computational cost of each one of the simulations involved in the optimisation process.

In this talk a novel approach for computing an off-line solution for a set of geometric parameters that define the computational domain will be presented. The proposed approach is based on the proper generalised decomposition [1] and, contrary to similar approaches [2], the geometric parameters are the position of the control points that define the NURBS boundary representation.

Examples involving the solution of Stokes flow problems in two and three dimensions will be used to demonstrate the potential of the proposed approach.



(a) (b) (c) (d)

Figure 1: Particularisation of the computed generalised solution for different geometric configurations.

REFERENCES

[1] Chinesta, F. and Keunings, R. and Leygue, A. *The proper generalized decomposition for advanced numerical simulations. A primer*. Springer, (2014).

[2] Zlotnik, S. and Díez, P. and Modesto, D. and Huerta, A. Proper generalized decomposition of a geometrically parametrized heat problem with geophysical applications. *Int. J. Num. Meth. Engng.* (2015) **103**:737–758.