## **Reduced Basis Method and Free-shape Parametrizations as Computational and Geometrical Reduction Strategies**

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**Abstract:** We review the application of reduced basis method as a computational reduction strategy for the approximation of viscous flows in parametrized domains by focusing on stability, accuracy and reliability of results. Then we introduce proper geometrical parametrization settings provided by the use of small deformations on control points placed into a bounding box by free-form-deformation techniques and on control points placed on the boundary of the domain by radial basis functions. These approaches allow to achieve a geometrical reduction in terms of number of parameters, used to represent the computational domains with a certain versatility. Numerical results will show some examples of applications in the study of cardiovascular flows, like bypasses, stenoses or bifurcations. A special attention is given to shape optimization and geometrical reconstruction/registration procedures as inverse problems. Another possible application deals with problems with free-boundary interfaces like fluid-structure interaction problems.

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