Model order reduction for turbulent and compressible flows: hybrid approaches in physics and geometry parametrization

Giovanni Stabile[1], **Matteo Zancanaro**[1], **and Gianluigi Rozza**[1]

[1] *International School for Advanced Studies, Via Bonomea 265, 34135, Trieste, Italy*

In this talk we will review recent developments on reduced order models for turbulent compressible flows.
In order to have an accurate turbulent model, we merge projection-based methods and data-driven techniques. The model utilizes classical Galerkin-projection method to solve for the reduced degrees of freedom approximating velocity and pressure. Instead, a data-driven technique for the approximation of the eddy viscosity solution manifold is employed.
As regards pressure stabilization, it is a matter that occurs both at the Full Order and at the Reduced Order levels, thus several different strategies have been developed in order to overtake the obstacle.
In this work the idea is to follow the segregated algorithms employed at the full order level also at the reduced level so that it is possible to have both a stable pressure recovery and a coherent reduced procedure at the same time. These type of segregated approaches are quite widespread in almost all finite volume solvers. The methodology is introduced for laminar incompressible flows and extended [1] to turbulent [2] and turbulent-compressible flows [3]
We show some results obtained by its application on problems with both physical and geometrical parametrization.

References

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