Reduced Order Methods for Nonlinear Time Dependent Optimal Flow Control Problems Applied to Environmental Marine Sciences and Engineering

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ABSTRACT

Optimal flow control problems governed by parametrized partial differential equations are usually complex and demanding, computationally speaking. The computational effort increases when one has to deal with nonlinear and/or time dependent governing equations.
In this talk we propose reduced order methods as a suitable approach to manage them in a fast and reliable way. We applied our methodology in environmental marine sciences and engineering: in this field, parametrized optimal flow control problems are usually studied for different parametric configurations in order to reliably describe several physical phenomena and their adaptive solutions are very demanding and costly. In order to save computational time, we exploit a POD-Galerkin reduction of the optimality system as an appropriate and rapid strategy to solve this issue, both for the linear and for the nonlinear case.
Two environmental applications are presented [1]: a pollutant control in the Gulf of Trieste, Italy and a solution tracking governed by quasi-geostrophic equations describing nonlinear North Atlantic Ocean dynamic.
Finally, we propose a parametrized reduced version of time dependent optimal control problems presented in [2, 3], remarking how reduce order methods could be advantageous to this context.

REFERENCES

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