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REDUCED BASIS METHOD FOR HYPERBOLIC SYSTEMS WITH NONLINEAR BOUNDARY CONDITIONS

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Model order reduction is an essential tool for control design and multi-query simulation in real-time scenarios. An example of an application domain is managed pressure drilling [1], which gives rise to models in terms of hyperbolic partial differential equations. The reduced basis (RB) method is a very efficient approach for dealing with parametrized systems.

Boundary conditions of these systems, either induced by the physics or by a controller, play a crucial role in their dynamics. Therefore, the correct implementation of the boundary conditions is necessary. Different approaches for dealing with Dirichlet boundaries have been introduced in [2]. However, handling nonlinear boundary conditions in reduced-order models can be challenging due to global nature of the basis functions and its independency over time.

We propose efficient strategies for dealing with nonlinear boundary conditions in hyperbolic systems. Besides many suggested remedies, a new ansatz representation for RB method has been proposed and tested on a hyperbolic system. Numerical results show that the proposed methodology is able to capture the local nonlinearities at the boundaries, ensuring an accurate solution of the system at a lower computational time than the one required by classical numerical techniques.

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