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A study of state-of-the-art model reduction techniques applied to flow simulations with moving immersed boundaries SERENA COSTANZO, TARANEH SAYADI, Sorbonne Université, PASCAL FREY, Sorbonne Université
— Reducing a detailed system into smaller sized models, capable of reproducing the main features and dynamics of the original configuration is a common practice in optimisation and control community, which could also serve as a way to make function evaluations less expensive. Since control is one of the future applications of this study it is necessary to identify the most suitable methodology applicable to detailed Navier-Stokes simulations for prediction purposes. To this end various strategies such as the GNAT method (Gauss-Newton with approximate tensors), POD with Galerkin regression method, implemented with the machine learning algorithm SINDy (Sparse Identification of Nonlinear Dynamics), and conventional POD-DEIM methods are compared in the context of an incompressible Navier-Stokes solver with immersed boundaries capabilities. The capability of these methods to interpolate between various operating conditions and to extrapolate the solution is investigated. The ability of each reduction strategy in dealing with existing nonlinearities and moving immersed boundaries is also identified.

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