Abstract Submitted
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Model Order Reduction for Fluid Dynamics with Moving Solid Boundary[1] HAOTIAN GAO, MINGJUN WEI, Kansas State University — We extended the application of POD-Galerkin projection for model order reduction from usual fixed-domain problems to more general fluid-solid systems when moving boundary/interface is involved. The idea is similar to numerical simulation approaches using embedded forcing terms to represent boundary motion and domain change. However, such a modified approach will not get away with the unsteadiness of boundary terms which appear as time-dependent coefficients in the new Galerkin model. These coefficients need to be pre-computed for prescribed motion, or worse, to be computed at each time step for non-prescribed motion. The extra computational cost gets expensive in some cases and eventually undermines the value of using reduced-order models. One solution is to decompose the moving boundary/domain to orthogonal modes and derive another low-order model with fixed coefficients for boundary motion. Further study shows that the most expensive integrations resulted from the unsteady motion (in both original and domain-decomposition approaches) have almost negligible impact on the overall dynamics. Dropping these expensive terms reduces the computation cost by at least one order while no obvious effect on model accuracy is noticed.

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