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A GOAL-ORIENTED MODEL REDUCTION TECHNIQUE FOR PARAMETRIC FLUID-STRUCTURE PROBLEMS

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The computation of the sound power level resulting from the vibration of submerged structures is a CPU time-consuming process in the naval industry, due to both geometrical complexity and strong coupling with the fluid. The goal is here to obtain a parametric reduced-order model (ROM), yielding a fast and accurate approximation of the radiated sound power level, when the parameters and the fluid loading vary. The proposed approach is an extension of [1] with the following new ingredients: (i) the goal-oriented formulation of the problem at hand; (ii) the reduction of both primal and dual vibroacoustic problems through reduced basis techniques; (iii) the use of a leave-one-out cross-validation (LOOCV) process in the offline step for the selection of the truncated representations; (iv) the reduction of the hydrodynamic loading [2]. It is shown, on a test case involving a submerged structure with variabilities of the structural parameters, that the approach enables to obtain an accurate approximation of the quantity of interest. The LOOCV technique moreover limits the offline CPU time and yields a cheap error estimator. The approach is versatile and may take into account frequency-dependent damping [3]. The CPU time gain compared to the full model evaluations is of several orders of magnitude, opening the way to new design strategies in the naval industry.

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