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Space-time reduced basis approximation and goal-oriented *a posteriori* error estimation for wave equation

***K.C. Hoang, P. Kerfriden, and S.P.A. Bordas**

Cardiff University, School of Engineering,
The Parade, CF24 3AA Cardiff, United Kingdom

*Corresponding author: hoangk@cardiff.ac.uk

We study numerically the linear second order wave equation with an output quantity of interest which is a linear functional of the field variable using reduced basis approximation methods in the space-time domain. The essential new ingredient is the *a posteriori* error estimation of the output quantity of interest. The technique, which is based on the well-known dual-weighted residual (DWR) method is deployed within a reduced basis approximation context. First, we introduce the reduced basis recipe – Galerkin projection onto a space Y_N spanned by the reduced basis functions which are constructed from the solutions of the governing PDE at several selected points in the parameter space. Second, in order to construct these basis functions we propose a new "goal-oriented" Proper Orthogonal Decomposition (POD)-Greedy sampling procedure, which is based on these new *a posteriori* error estimations. Finally, this *a posteriori* error estimation is also used to evaluate approximately the quality of many output computations in the online stage within the reduced basis procedure.

Keywords: second order wave equation, reduced basis method, dual weighted residual method, goal-oriented error estimation, dual problem, POD-Greedy algorithm