A FAST BLOCK-GREEDY ALGORITHM FOR QUASI-OPTIMAL MESHLESS TRIAL SUBSPACE SELECTION

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Abstract. Meshless collocation methods are often seen as a flexible alternative to overcome difficulties that may occur with other methods. As various meshless collocation methods gain popularity, finding appropriate settings becomes an important open question. Previously, we proposed a series of sequential-greedy algorithms for selecting quasi-optimal meshless trial subspaces that guarantee stable solutions from meshless methods, all of which were designed to solve a more general problem: "*Let A be an $M \times N$ matrix with full rank M; choose a large $M \times K$ submatrix formed by $K \leq M$ columns of A such that it is numerically of full rank.*" In this talk, we propose a block-greedy algorithm based on a primal/dual residual criterion. Similar to all algorithms in the series, the block-greedy algorithm can be implemented in a matrix-free fashion to reduce the storage requirement. Most significantly, the proposed algorithm reduces the computational cost from the previous $\mathcal{O}(K^4 + NK^2)$ to at most $\mathcal{O}(NK^2)$. Numerical examples are given to demonstrate how this efficient and ready-to-use approach can benefit the stability and applicability of meshless collocation methods.

Key words. Kansa method, kernel collocation, radial basis function, adaptive greedy algorithm, basis selection.

AMS subject classifications. 65D15, 65N35, 41A63.

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