Investigation of Block Krylov Subspace Methods with Dummy Right-Hand Sides for Solving Linear Systems Obtained By Extended Element-Free Galerkin Method

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Abstract: The purpose of this study is to efficiently solve N by N linear systems $Ax = b$ obtained by eXtended Element-free Galerkin method (X-EFG). X-EFG is one of the meshless methods for discretizing partial differential equations, and the linear systems have asymmetric saddle point structure. In this study, the block Krylov subspace methods have been applied for solving linear systems obtained by X-EFG. Note that the block Krylov subspace methods are usually employed for solving linear systems with multiple right hand sides, $AX = B$, where $X = [x_1, x_2, \ldots, x_L]$, $B = [b_1, b_2, \ldots, b_L]$, and L is the number of right-hand sides. In this study, although the number of right-hand sides does not exist more than two, we set some dummy right-hand sides for applying block Krylov subspace methods. This is because, convergence of block Krylov subspace methods is sometimes more quickly than that of non-block ones. Namely, there is a possibility that the asymmetric saddle point problems can be solved efficiently by using block Krylov subspace methods with dummy right-hand sides. Since many kinds of dummy right-hand sides may be set for applying block Krylov subspace methods, appropriate ones are investigated in this study. Results and discussions will be presented at the conference.