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SEBSM-BASED RESIDUAL ITERATIVE METHOD FOR SOLVING LARGE SYSTEMS OF LINEAR EQUATIONS AND ITS APPLICATIONS IN COMPUTATIONAL MECHANICS

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In this paper, a residual iterative method for solving sparse non-symmetrical systems of linear equations is proposed based on the Simultaneous Elimination and Back-Substitution Method (SEBSM). And the method is applied to solve systems resulted in some numerical methods for solving solid mechanics problems, such as the boundary element method (BEM), finite element method (FEM), and Meshless method. First, SEBSM is introduced to solve general linear systems using the direct method. And, then an iterative method for reducing the residual of the system of equations is presented based on a Newton-Raphson iterative technique. In each residual iteration, modification values to the unknowns of the system are solved through an inner iterative process and by using an iterative matrix. By splitting the coefficient matrix of the system into a lower and an upper matrices, the lower matrix is served as the iterative matrix and the upper one is used to form the right-hand side of the equation set in iteration. The lower matrix has a certain bandwidth along the diagonal line. The required storage space and iterative convergence are completely controlled by selecting a suitable bandwidth of the lower matrix. The sparsity of the iterative matrix can largely save the required computer storage space and the bandwidth of the iterative matrix can make the method have a faster convergence than the frequently used Gauss-Seidel iterative method. As a result of these advantages, large-scale linear systems can be solved using the proposed method.