

Solving the Direct and Inverse Stokes Problems by the Boundary Knot Method and Laplacian Decomposition

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A meshfree numerical scheme based on the boundary knot method (BKM) is proposed for the two-dimensional direct and inverse Stokes problems, which is highly ill-conditioned. Due to the Laplacian decomposition, the coupled Stokes equations are converted to three Laplace equations. Then the BKM, which is a boundary-type meshless collocation scheme, is used to solve these three Laplace equations. In comparing with the method of fundamental solutions, the sources in BKM are located along the physical boundary to avoid the choice of the source positions. In BKM, the numerical solutions of these three Laplace equations are expressed by nonsingular general solution of two-dimensional Laplace equations. The unknown coefficients in the solution expressions are then found by satisfying the boundary conditions at the boundary collocation points. Several numerical examples will be provided to demonstrate the efficacy and stability of the proposed scheme for solving the direct and inverse Stokes problems.

Keywords: boundary knot method, Stokes problem, Laplacian decomposition, boundary-type meshless collocation method.