An efficient multiscale-like multigrid computation for 2D convection-diffusion equations on nonuniform grids

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Abstract

An efficient multiscale-like multigrid (MSLMG) method is presented to solve the two-dimensional (2D) convection-diffusion equations on nonuniform grids, based on the transformation-free high order compact (HOC) difference scheme. By providing appropriate initial solutions, the discretization systems on the two finest grids are solved to obtain the MSLMG solutions with discretization-level accuracy by performing few multigrid cycles, which implemented with alternating line Gauss-Seidel smoother, interpolation and restriction on nonuniform grids. Numerical experiments of two boundary layer and local singularity problems are conducted to demonstrate the proposed algorithm is efficient and effective to decrease the computational cost.