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A STABLE MULTIGRID STRATEGY FOR CONVECTION-DIFFUSION USING HIGH ORDER COMPACT DISCRETIZATION*

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Abstract. Multigrid schemes based on high order compact discretization are developed for convection-diffusion problems. These multigrid schemes circumvent numerical oscillations and instability, while also yielding higher accuracy. These instabilities are typically exacerbated by the coarser grids in multigrid calculations. Our approach incorporates a 4th order compact formulation for the discretization, while also constructing a consistent multigrid restriction scheme to preserve the accuracy of the fine-to-coarse grid projections. Numerical results demonstrating the higher accuracy and robustness of this approach are presented for representative 2D convection-diffusion problems. These calculations also confirm that our numerical algorithms exhibit the typical multigrid efficiency and mesh-independent convergence properties.

Key words. convection-diffusion, high-order compact discretizations, multigrid.

AMS subject classifications. 65F10,65N06,65N22,65N55.

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