Supercloseness of continuous interior penalty method for convection-diffusion problems with characteristic layers

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A singularly perturbed convection-diffusion problem posed on the unit square is solved using a continuous interior penalty (CIP) method with piecewise bilinears on a rectangular Shishkin mesh. A detailed analysis [1] proves a new stability bound for the CIP method, in a norm that is stronger than the usual CIP norm. This bound enables a new supercloseness result for the CIP method: the computed solution is shown to be second order (up to a logarithmic factor) convergent in the new strong norm to the piecewise bilinear interpolant of the true solution. As a corollary one obtains almost optimal order convergence in the L^2 norm of the CIP solution to the true solution. Numerical experiments illustrate these theoretical results.

KEY WORDS: Convection-diffusion, boundary layer, interior penalty finite element method, Shishkin mesh

REFERENCES

1. Jin Zhang and Martin Stynes, Supercloseness of continuous interior penalty method for convection-diffusion problems with characteristic layers, Comput. Methods Appl. Mech. Engrg. (to appear).

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