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Durán, R.G.; Lombardi, A.L.; Prieto, M.I.
Superconvergence for finite element approximation of a convection-diffusion equation using graded meshes
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MSC Classification: 65N30 65N12

Keywords: convection-diffusion equation; finite element approximation; superconvergence; graded meshes

Review text:
The article treats the superconvergence property of $\mathcal{Q}_1$ rectangular finite elements using a graded mesh for a model of the convection–diffusion problem. The graded mesh is an alternative to the Shishkin type and studied recently by the authors. It is proved that, if u_h (where h is a parameter related to the definition of the mesh) is the finite element solution and u_I is the Lagrange interpolation of the exact solution u, $\| u_h - u_I \|_\varepsilon$ is of higher order than that of $\| u_h - u \|_\varepsilon$, where $\| \cdot \|_\varepsilon$ denotes to a weighted H^1-norm associated with the symmetric part of the differential equation. This stated superconvergence result with some existing interpolation error estimates yields an optimal–order convergence in L^2–norm. Both superconvergence in $\| \cdot \|_\varepsilon$-norm and optimal convergence order in L^2–norm stated before are almost optimal in the sense that the constants depend only on the logarithm of the singular perturbation parameter. These results have been obtained thanks to the combination of some known results concerning the superconvergence property and graded meshes. The article is useful and it deserves to be read.

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