A singularly perturbed problem on a Duran-Lombardi mesh

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We consider a singularly perturbed convection-diffusion problem on unite square whose solution may have exponential and parabolic boundary layers. The problem is solved numerically by a finite element method with piecewise bilinear elements on a graded Duran-Lombardi mesh. We prove uniform convergence of this method in an energy norm. Furthermore, by using a streamline-diffusion version of the method (SDFEM) we are able to perform analysis of the supercloseness property of the SDFEM in the corresponding streamline-diffusion norm. Our analysis offers a choice of parameters which improves stability.