

## ***hp*-FEMs for singularly perturbed problems with two small parameters**

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We consider singularly perturbed boundary value problems, in which the two highest order derivatives are multiplied by a small parameter. The solution to such problems will develop boundary layers of different scales, based on the relationship between the two parameters. The numerical approximation of the solution to such problems must take these phenomena into account, in order to yield robust results.

We will first discuss the regularity of the solution to second and fourth order problems in 1-D, and present an *hp* FEM for which we establish robust, exponential convergence in the energy norm, as the degree  $p$  of the approximating polynomials increases.

Next, we will present the numerical analysis for the same problems posed in 2-D, assuming the solution possesses regularity which mimics the 1-D case.

In both cases, the *Spectral Boundary Layer* mesh will be used.

Numerical results will also be presented.