

**FINITE ELEMENT METHODS FOR
SINGULARLY PERTURBED HIGHER
ORDER ELLIPTIC TWO-POINT
BOUNDARY VALUE PROBLEMS WITH
TWO BOUNDARY LAYERS**

Guangfu Sun & Martin Stynes

Piecewise polynomial Galerkin finite element methods are constructed on a Shishkin mesh for a class of singularly perturbed two-point boundary value problems of order greater than two. The methods are proved to be convergent, uniformly in the perturbation parameter, in various norms. Some numerical results are presented for a fourth order problem. Full details are in [1].

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SINGULARLY PERTURBED HIGHER ORDER
ELLIPTIC TWO-POINT BOUNDARY VALUE
PROBLEMS II: CONVECTION-DIFFUSION TYPE**

Guangfu Sun & Martin Stynes

We consider singularly perturbed high order elliptic two-point boundary value problems of convection-diffusion type. Under suitable hypotheses, the coercivity of the associated bilinear form is proved and a representation result for the solutions of such problems is given. A family of Galerkin finite element methods based on piecewise polynomial test/trial functions on a Shishkin mesh is constructed and proved to be convergent, uniformly in the perturbation parameter, in energy and W_∞^k norms. Numerical results are presented for a second order problem and fourth order problems. Full details appear in [2].

**FINITE ELEMENT METHODS
ON PIECEWISE EQUIDISTANT MESHES
FOR INTERIOR TURNING POINT PROBLEMS**

Guangfu Sun & Martin Stynes

We consider linear second order singularly perturbed two-point boundary value problems with interior turning points. Piecewise linear Galerkin finite element methods are constructed on various piecewise equidistant meshes designed for such problems. These methods are proved to be convergent, uniformly in the singular perturbation parameter, in a weighted energy norm and the usual L^2 norm. Numerical results are presented. Full details appear in [3].

References

- [1] G. Sun and M. Stynes, *Finite element methods for singularly perturbed higher order elliptic two-point boundary value problems with two boundary layers* (1992) (Preprint 1992-6, Mathematics Department, University College Cork).
- [2] G. Sun and M. Stynes, *Finite element methods for singularly perturbed higher order elliptic two-point boundary value problems II: convection-diffusion type* (1993) (Preprint 1993-5, Mathematics Department, University College Cork).
- [3] G. Sun and M. Stynes, *Finite element methods on piecewise equidistant meshes for interior turning point problems* (1993) (Preprint 1993-10, Mathematics Department, University College Cork).

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