

## Parameters-uniform numerical method for a partially singularly perturbed linear system of equations of reaction-diffusion type - a special case

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### ABSTRACT

A partially singularly perturbed linear system of second order differential equations is considered in the form,

$$-E\vec{u}''(x) + A(x)\vec{u}(x) = \vec{f}(x), \quad x \in (0, 1) \quad \text{with } \vec{u}(0) \text{ and } \vec{u}(1) \text{ given.}$$

Here  $\vec{u}$  is a column  $n$ -vector,  $E$  and  $A(x)$  are  $n \times n$  matrices,  $E = \text{diag}(\vec{\varepsilon})$ ,  $\vec{\varepsilon} = (\varepsilon_1, \dots, \varepsilon_n)$ . The parameters  $\varepsilon_i$ ,  $i = 1, \dots, m$ ,  $m < n$ , are assumed to be distinct and, for convenience, the ordering  $0 < \varepsilon_1 < \varepsilon_2 < \dots < \varepsilon_m = \varepsilon_{m+1} = \dots = 1$  is assumed. The first  $m$  components of the solution exhibit overlapping layers and the remaining  $n - m$  components have less-severe overlapping layers. A layers resolving piecewise uniform Shishkin mesh is constructed on which a classical finite difference scheme is applied. Second order convergence of the method is proved. Numerical illustrations are presented in support of the theory. Related works are found in [1], [2].

### References

- [1] P. MARAGATHA MEENAKSHI, S. VALARMATHI AND J.J.H. MILLER, Solving a partially singularly perturbed initial value problem on shishkin meshes, *Applied Mathematics and Computations*, (2010).
- [2] M. PARAMASIVAM, S. VALARMATHI AND J.J.H. MILLER, Second order parameter-uniform convergence for a finite difference method for a singularly perturbed linear reaction-diffusion system (*communicated*).

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