A finite element analysis of a coupled system of singularly perturbed reaction-diffusion equations

Torsten Linß* Niall Madden†

Preprint MATH-NM-08-2002
Technische Universität Dresden
July 2002

Abstract

We consider a system of two coupled reaction-diffusion equations. When the parameters multiplying the second-order derivatives in the equations are small, their solutions exhibit boundary layers. Moreover, when the parameters are of different magnitudes, two distinct but overlapping boundary layers are present. We study a finite element discretization on general layer-adapted meshes including the frequently studied Shishkin mesh and the Bakhvalov mesh. Supporting numerical results are presented.

Keywords: Reaction diffusion, singular perturbation, solution decomposition, Shishkin mesh.

*Institut für Numerische Mathematik, Technische Universität Dresden, D-01062 Dresden, Germany; email: `torsten@math.tu-dresden.de`.

†Department of Mathematics, National University of Ireland, Galway; email: `niall.madden@nuigalway.ie`. The work of this author was supported by NUI, Galway Millennium Research Fund MF8/01/M.