A uniformly convergent numerical method for a coupled system of two singularly perturbed linear reaction-diffusion problems

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Abstract

A coupled system of two singularly perturbed linear reaction-diffusion two-point boundary value problems is examined. The leading term of each equation is multiplied by a small positive parameter, but these parameters may have different magnitudes. The solutions to the system have boundary layers that overlap and interact. The structure of these layers is analysed, and this leads to the construction of a piecewise-uniform mesh that is a variant of the usual Shishkin mesh. On this mesh central differencing is proved to be almost first-order accurate, uniformly in both small parameters. Supporting numerical results are presented for a test problem.

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