

A Boundary Layer Resolving Numerical Method for Singularly Perturbed Delay Differential Equations of Large Delay Arising in Control Theory

Rajagopal S¹, Dinesh Kumar S^{1*}

¹Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, Vellore, Tamil Nadu, India.

**Corresponding Author Email: mathdinesh005@gmail.com*

Abstract

A boundary value method for singularly perturbed two point boundary value problems governed by second order delay differential equations is presented in this study. The examination of anticipated first exit periods of membrane potentials in neural models is one area where such issues arise. The approach breaks down the initial problem into subproblems for the inner and outside regions. While the inner region problem is formulated using a general stretching transformation to incorporate boundary layer effects, the outer solution is derived from the reduced problem. The reduced solution is used to determine the boundary condition at the interface. Next, a two point boundary value problem is used to solve the modified inner problem. The inner and outer solutions are combined to create an approximate solution to the original problem.

Keyword: singular perturbation, delay differential equation, inner region, outer region, boundary value.