Sakai, Manabu; **Usmani, Riaz A.**

A class of simple exponential B-splines and their application to numerical solution to singular perturbation problems. (English) Zbl 0676.65088

Numer. Math. 55, No. 5, 493-500 (1989).

The authors consider an application of simple exponential splines to the numerical solution of singular perturbation problem: $\epsilon y'' + b(x)y' - d(x)y = f(x)$, $(0\leq x \leq 1)$, $y(0) = \alpha$, $y(1) = \beta$. More specifically, they propose a numerical scheme of collocation type using fourth order exponential splines. After giving the convergence theorem of order two for the numerical solution, they show two numerical examples to exhibit the less computational effort of their method than those of other methods of exponential type.

Reviewer: T.Mitsui

MSC:

65L10 Numerical solution of boundary value problems involving ordinary differential equations

34B05 Linear boundary value problems for ordinary differential equations

34E15 Singular perturbations for ordinary differential equations

Keywords:

exponential splines; singular perturbation; collocation type; convergence; numerical examples; methods of exponential type

Full Text: DOI EuDML

References:

[1] Abrahamsson, L.R., Keller, H.B., Kreiss, H.-O.: Difference approximations for singular perturbations of systems of ordinary differential equations. Numer. Math.22, 367-391 (1974) · Zbl 0314.65042 · doi:10.1007/BF01436920

[2] Berger, A., Solomon, J., Ciment, M.: An analysis of a uniformly accurate difference method for a singular perturbation problem. Math. Comput.37, 79-94 (1981) · Zbl 0471.65062 · doi:10.1090/S0025-5718-1981-0616361-0

[3] Berger, A., Solomon, J., Ciment, M., Leventhal, S., Weinberg, B.: Generalized OCI schemes for boundary layer problems. Math. Comput.35, 695-731 (1980)· doi:10.1090/S0025-5718-1980-0572850-8

[4] Kellogg, R., Tsan, A.: Analysis of some difference approximations for a singular perturbation problem without turning points. Math. Comput.32, 1025-1039 (1978) · Zbl 0418.65040 · doi:10.1090/S0025-5718-1978-0483484-9

[5] Sakai, M., López de Silanes, M.C.: A simple rational spline and its application to monotonic interpolation to monotonic data. Numer. Math.50, 171-182 (1986) · Zbl 0632.65006 · doi:10.1007/BF01390428

[6] Schmumaker, L.: Spline functions: Basic theory. New York: Wiley 1981