A Collocation Method for Singularly Perturbed Two-Point Boundary Value Problems with Splines in Tension*

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An error bound for the collocation method by spline in tension is developed for a nonlinear boundary value problem $ay'' + by' + cy = f(\cdot, y),\ y(0) = y_0,\ y(1) = y_1$. Sharp error bounds for the interpolating splines in tension are used in conjunction with recently obtained formulae for B-splines, to develop an error bound depending on the tension parameters and net spacing. For singularly perturbed boundary value problems ($|a| = \varepsilon \ll 1$), the representation of the error motivates a choice of tension parameters which makes the convergence of the collocation method problem at least linear. The B-representation of the spline in tension is also used in the actual computations. Some numerical experiments are given to illustrate the theory.

Subject classification: AMS(MOS) 65D07, 65L10, 65L60, 76D30

Keywords: spline in tension, ordinary differential equation

*Supported by grant 037011 of the Ministry of Science and Technology, Croatia