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Summary of Abstract

Various phenomena in mathematical physics, astrophysics, control theory, population modelling, chemistry, biology, finance, social science, and fluid dynamics are frequently modelled by using ordinary and partial differential equations. There are many applications of differential equations in the dynamical system, where we control the chaos in many real life problems. The main motive of present thesis is to develop high order numerical techniques for solving boundary value problems using B-spline basis functions. The thesis consists of six chapters. The chapter-wise summary is given herewith. **Chapter 1.** In this chapter, some historical background of singularly perturbed problem, singularly perturbed differential difference equations, singular boundary value problems(BVPs) and fractional differential equations are given. Basic definitions of B-spline basis functions of various kind are also given. **Chapter 2.** In this chapter, an efficient and high order numerical technique based on the quartic trigonometric B-spline collocation method with quasilinearization approach to compute approximate solution of Lane-Emden equations subjected to Neumann and Robin boundary conditions arising in various physical models is presented. **Chapter 3.** In this chapter, trigonometric quintic B-spline method is proposed for the solution of a class of turning point singularly perturbed boundary value problems (SPBVPs) whose solution exhibits either twin boundary layers near both endpoints of the interval of consideration or an interior layer near the turning point. **Chapter 4.** In this chapter, a numerical method is proposed for singularly perturbed parabolic convection-diffusion equation (SPPCDEs) whose solution exhibits boundary layers near the right endpoints of the domain of consideration. **Chapter 5.** In this chapter, a higher-order numerical algorithm for singularly perturbed differential-difference convection-diffusion equation with retarded term appearing in computational biological science is discussed. **Chapter 6.** In this chapter, an efficient high-order numerical scheme to approximate the class of multi-term time-fractional diffusion equations is studied.