Abstract

In this thesis, we consider numerical solutions of linear and nonlinear Fredholm integral equations. We propose multi-projection and iterated multi-projection methods for Fredholm integral equations of the second kind with a smooth kernel using Legendre polynomial bases. We obtain superconvergence results for the approximate solutions. More precisely, we prove that in Legendre M-Galerkin and Legendre M-collocation methods not only the iterative solution $\tilde{u}_n$ approximates the exact solution u in the infinity norm with the order of convergence n^{-4r}, but also the derivatives of $\tilde{u}_n$ approximate the corresponding derivatives of u in the infinity norm with the same order of convergence. Next we consider the Galerkin and collocation methods for solving the nonlinear integral equations of Hammerstein and Urysohn type with smooth kernels using Legendre polynomial bases. We obtain convergence rates for the approximate solutions in both L^2-norm and infinity norm. Also we obtain superconvergence results for the iterated Legendre Galerkin solutions in both L^2-norm and infinity norm. We prove that the iterated Legendre Galerkin method improves over the iterated Legendre collocation method for both Hammerstein and Urysohn integral equations. We extend these results to the Hammerstein integral equations of mixed type with a smooth kernel using Legendre polynomial basis functions and obtain similar superconvergence results for the approximate solutions in both L^2-norm and infinity norm.

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