Abstract

In the first part of the thesis, we consider numerical approximation of eigenelements of a compact integral operator defined on a complex Banach space. First we consider the truncated wavelet Galerkin method for eigenvalue problem of a compact integral operator with a smooth kernel based on matrix compression techniques and obtain the convergence rates for the approximation of eigenelements. We discuss two iterative refinement schemes for the approximation of eigenelements based on the matrix compression techniques and obtain the convergence rates for the eigenelements for each step of iterations. Next we discuss the discrete Galerkin and discrete collocation methods for the approximation of eigenelements of a two-dimensional compact integral operator with a smooth kernel defined on a complex Banach space and obtain the superconvergence results for the eigenelements. Further, we improve the convergence rates for eigenvalues using Richardson extrapolation in both iterated discrete Galerkin and iterated discrete collocation methods. Next we discuss Legendre Galerkin, Legendre collocation, Legendre M-Galerkin and Legendre M-collocation methods for the approximation of eigenelements using Legendre polynomial basis and we obtain superconvergence results. We illustrate our results by numerical examples.

The second part of the thesis is concerned about fine spectrum of generalized second order difference operator Δ^2_{uvw} on sequence space c_0 and l_1, where u, v and w are two real sequences with some restrictions. We calculate the spectrum, point spectrum, residual spectrum and continuous spectrum of the operator Δ^2_{uvw} on sequence space c_0 and l_1.

Keywords: Eigenvalue problem, Compact integral operator, Superconvergence results, Fine spectrum.