Abstract

The concept of unbounded operators provides an abstract framework for dealing with differential operators and unbounded observable such as in quantum mechanics. The theory of unbounded operators was developed by John Von Neumann in the late 1920s and early 1930s in an effort to solve quantum mechanics and other physical observables. This has provided the background on which other scholars have developed their work in differential operators. Higher order differential operators as defined on Hilbert spaces have received much attention though there still lies the problem of computing the eigenvalues of these higher order operators when the coefficients are unbounded. Using asymptotic integration, we have investigated the asymptotics of the eigenvalues and the deficiency indices of fourth-order differential operators with unbounded coefficients as well as the location of absolutely continuous spectrum of self-adjoint extension operators. The objectives of this research were to compute eigenvalues of fourth order differential operators when the coefficients are unbounded, determine the deficiency indices of such differential operator and the location of the absolutely continuous spectrum of self-adjoint extension operator together with their spectral multiplicity. These results have enriched the available literature on the spectral theory of higher order differential operators and can also be applicable in quantum mechanics where results of self-adjoint operators are very much useful. In solving these problems, we applied the techniques of asymptotic integration as outlined in Levinson's theorem which is a perturbation result.