Abstract

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Using Legendre and Other Bases in Solving Some Differential and Integro-Differential Equations

Differential, integro-differential and integral equations lie at the centre of mathematics, bringing together the best of the abstraction and power of pure mathematics to address some of the most important problems, both classical and modern, in applied mathematics. Numerical methods have played an important role in solving differential, integro-differential and integral equations because analytical solutions are hard even impossible to obtain. One of the numerical techniques used to solve differential, integro-differential and integral equations is Galerkin Method. One of the most common orthogonal polynomial set is the Legendre polynomials. Legendre polynomials are widely used in boundary problems because of the orthogonality on the interval [?1 1]. We used Galerkin method with Legendre bases to solve higher order differential, Sturm- Liouville, system of integro-differential, integral and integro-differential equation. Also, the comparison between Legendre-Galerkin method and variational iteration method is emphasized by solving the higher order differential equations. It is shown that Legendre-Galerkin method yields better results than variational iteration method. For numerical approximations of differential equations which are set on semiinfinite intervals, an effective tool is to use the Laguerre polynomials/functions which are mutually orthogonal with respect to appropriate inner product in [0,1). We introduce in this thesis the numerical solution of the Bessel function and the integro-differential equation in the domain [0, infinity) by using Laguerre-Galerkin method.