High order numerical solution of the linear integral equations

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We consider the Fredholm integral equation of the second kind

\[ u(x) + \lambda \int_a^b k(x, y) u(y) \, dy = f(x), \]  

where the functions \( k(x, y) \) and \( f(x) \) are smooth functions. The numerical solutions of this problem has been discussed in many books and papers, for example see[1, 2]. We derive an explicit representation of the extrapolation methods to provide an efficient method for numerical approximation of the integrals in an arbitrary grid points:

\[ T_{j-1}^{(k+1)} = \sum_{i=0}^{N} w_i f(x_i). \]  

(2)

The order of this method is increasing with \( N \). The convergence of the given approximation for a small number of nodes is evident in numerical analysis. The discretization of the integral equation based on this approximation will provide many advantages in practical methods. Some of them are: the rapid convergence, using the arbitrary set of points in the discretization, the straightforward extension of the method for the integro-differential equations and many other advantages can easily verified. The implementation of this method for nonlinear problems is also a interesting problem and has many applications in science and engineering.

References
