Numerical solution of second-order linear fredholm integro-differential equation using generalized minimal residual method

Abstract

Problem statement: This research purposely brought up to solve complicated equations such as partial differential equations, integral equations, Integro-Differential Equations (IDE), stochastic equations and others. Many physical phenomena contain mathematical formulations such integro-differential equations which are arise in fluid dynamics, biological models and chemical kinetics. In fact, several formulations and numerical solutions of the linear Fredholm integro- differential equation of second order currently have been proposed. This study presented the numerical solution of the linear Fredholm integro-differential equation of second order discretized by using finite difference and trapezoidal methods. Approach: The linear Fredholm integro-differential equation of second order will be discretized by using finite difference and trapezoidal methods in order to derive an approximation equation. Later this approximation equation will be used to generate a dense linear system and solved by using the Generalized Minimal Residual (GMRES) method. Results: Several numerical experiments were conducted to examine the efficiency of GMRES method for solving linear system generated from the discretization of linear Fredholm integro-differential equation. For the comparison purpose, there are three parameters such as number of iterations, computational time and absolute error will be considered. Based on observation of numerical results, it can be seen that the number of iterations and computational time of GMRES have declined much faster than Gauss-Seidel (GS) method. Conclusion: The efficiency of GMRES based on the proposed discretization is superior as compared to GS iterative method.