Quarter-sweep projected modified gauss-seidel algorithm applied to linear complementarity problem

Abstract

Problem statement: Modified Gauss-Seidel (MGS) was developed in order to improve the convergence rate of classical iterative method in solving linear system. In solving linear system iteratively, it takes longer time when many computational points involved. It is known that by applying quarter-sweep iteration scheme, it can decrease the computational operations without altering the accuracy. In this study, we investigated the effectiveness of the new Quarter-Sweep Projected Modified Gauss-Seidel (QSPMGS) iterative method in solving a Linear Complementarity Problem (LCP). Approach: The LCP we looked into is the LCP arise in American option pricing problem. Actually, American option is a Partial Differential Complementarity Problem (PDCP). By using full-, half- and quarter-sweep Crank-Nicolson finite difference schemes, the problem was reduced to Linear Complementarity Problem (LCP). Results: Several numerical experiments were carried out to test the effectiveness of QSPMGS method in terms of number of iterations, computational time and root mean square error (RMSE). Comparisons were made with full-, half- and quarter-sweep algorithm based on Projected Gauss-Seidel (PGS) and Projected Modified Gauss-Seidel (PMGS) methods. Thus, the experimental results showed that the QSPMGS iterative method has the least number of iterations and shortest computational time. The RMSE of all tested methods are in good agreement. Conclusion: QSPMGS is the most effective among the tested iterative methods in solving LCP whereby it is fastest and the accuracy remains the same.