An efficient red–black skewed modified accelerated arithmetic mean iterative method for solving two-dimensional poisson equation

ABSTRACT

This paper presents the extended variants to the established two-stage Arithmetic Mean (AM) method known as the Modified Accelerated Arithmetic Mean (MAAM) and Skewed Modified Accelerated Arithmetic Mean (SkMAAM) methods to solve the two-dimensional elliptic problem. The existing two-stage AM and its skewed variants apply one weighted parameter for the computation of nodes in Levels 1 and 2. The suggested MAAM and SkMAAM methods employ red–black ordering with two different weighted parameters and an additional two distinct accelerated parameters for red and black nodes, respectively. By carefully choosing optimum parameter values, the proposed MAAM and SkMAAM improve the computational execution of the algorithm. With red–black ordering, the computational molecules of red and black nodes are symmetrical, in which the computation of red nodes applies the updated values of their four neighbouring black nodes and vice versa. These symmetrical computational molecules of red and black nodes can be seen for the modified variants MAM and MAAM, and their corresponding skewed variants SkMAM and SkMAAM. The proposed MAAM and SkMAAM methods are compared to the existing AM and Modified AM (MAM) and their corresponding skewed variants, namely the Skewed AM (SkAM) and Skewed MAM (SkMAM) methods. The performance of the newly proposed MAAM and SkMAAM methods is compared against the existing methods in terms of computational complexity and actual execution time. It is shown in the simulation results that the skewed variants are superior to their corresponding regular variants, in which the SkMAAM method gives the best performance.