Direct integration of boundary value problems using the block method via the shooting technique combined with Steffensen's strategy

ABSTRACT

This study is intended to evaluate numerically the solution of second order boundary value problems (BVPs) subject to mixed boundary conditions using a direct method. The mixed set of boundary conditions is subsumed under Type 1: mixed boundary conditions of Dirichlet and Robin and Type 2: mixed boundary conditions of Robin and Neumann. The direct integration procedure will compute the solutions at two values concurrently within a block with a fixed step size. The shooting technique adapted to the derivative free Steffensen method is employed as the iterative strategy to generate the new initial estimates. Four numerical examples are given to measure the efficiency and effectiveness of the developed numerical scheme of order six. The computational comparison indicates that the proposed method gives favorably competitive performance compared to the existing method in terms of accuracy, total function calls, and time saving.