SHOOTING METHOD WITH ROOT FINDING TO SOLVE BOUNDARY VALUE PROBLEMS

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ABSTRACT

The shooting method is an effective numerical approach for solving boundary value problems (BVPs) by converting it into initial value problems (IVPs). This method involves guessing initial conditions and iteratively adjusting them until the solution satisfies the boundary conditions at the other end of the domain. Root-finding algorithms are important in this process since they help to solve the nonlinear equations that result from the mismatch between the computed and desired boundary conditions. In this study, the result of the shooting method combined with various root-finding algorithms such as the Bisection method, Secant method, Newton's method, Ridder's method, Halley's method, Brent's method, Modified Newton method and Improved Ostrowski's method to solve BVPs is evaluated. The aim of the study is to analyze the effectiveness of these algorithms regarding their convergence rate, accuracy, and robustness. Several second-order nonlinear boundary value problems are tested to assess the effectiveness of each method. The findings indicate that, Shooting Method with Ridder Method is the best method for method that required two initial guesses since it offers the lowest error and fastest CPU time making it good for problems where robustness is critical. For one-guess method, Shooting Method with Improved Ostrowski Method is the best method as it achieves the lowest error, fastest CPU time, and fewest iterations. The results highlight the effectiveness of the shooting method with root-finding algorithms in providing accurate and efficient solutions to BVPs, making it a valuable tool in scientific and engineering applications.

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