Numerical solution of Boundary Layer Equations based on Optimization

Adélcio C. Oliveira [4]

Resumo: The Parameter Optimization Method was presented with analytical and numerical examples. It was shown that it is a useful tool for solving differen- tial equations with contour conditions. The method was used to solve a one-dimensional Nonlinear Schrödinger Equation, a nonlinear Euler- Bernoulli beam, the Landau-Levich equation. The method was generalized for solving the the Blasius equation and for the Ostrach system where investigated. It is a combination of optimization procedure and Shooting Method. It was shown to be possible and easy to obtain an accurate solution for the Blasius equation. It was also demonstrated that the Ostrach system can be solved by IVASO. This system has a large sensibility to initial conditions, and that its solution for near zero ($\eta \approx 0$) is strongly correlated with its solution far from the origin ($\eta \gg 0$), and consequently, an accurate solution for the boundary layer demands a highly accurate solution of the initial values problem, this is similar to the butterfly effect usually studied in chaotic systems. The results indicate that the method is a better choice when the differential equation is nonlinear and finite differences is not of easy implementation. Conceptually, IVASO is simpler and demand less previous knowledge comparing with others related numerical methods.

Referências

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[4]Universidade Federal de São João Del Rei, Departamento de Estatística, Física e Matemática, adelcio@ufsj.edu.br