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Rational Chebyshev collocation approach in the solution of the axisymmetric stagnation flow on a circular cylinder. (English) [Zbl 1424.65232]

Summary: In this paper, a spectral collocation approach based on the rational Chebyshev functions for solving the axisymmetric stagnation point flow on an infinite stationary circular cylinder is suggested. The Navier-Stokes equations which govern the flow, are changed to a boundary value problem with a semi-infinite domain and a third-order nonlinear ordinary differential equation by applying proper similarity transformations. The approach is named the rational Chebyshev collocation (RCC) method. This method reduces this nonlinear ordinary differential equation to an algebraic equations system. RCC method is a strong kind of the collocation technique to solve the problems of boundary value over a semi-infinite interval without truncating them to a finite domain. We also present the comparison of this work with others and show that the present method is more effective and precise.

MSC:

65N35 Spectral, collocation and related methods for boundary value problems involving PDEs
35Q35 PDEs in connection with fluid mechanics
76D05 Navier-Stokes equations for incompressible viscous fluids

Keywords:
axisymmetric flow; stagnation point; collocation method; rational Chebyshev functions; boundary value problem

Full Text: Link