ABSTRACT

The use of parabolized Navier-Stokes (PNS) equations to model internal flow problems has been gaining momentum. The main advantage of using PNS equations to simulate incompressible viscous flows is the suppression of elliptical behavior in the streamwise direction of the flow wherein the governing equations become parabolic in this direction. Thus, these equations are solvable by space-marching techniques, saving considerable storage and computational time. Patankar and Spalding (1972), Briley (1974), Garg (1985), Pouagare and Lakshminarayana (1986) and Govindan and Lakshminarayana (1988) have developed their own scheme to solve the PNS equations for developing flow in straight ducts. Their computations reveal a remarkable agreement with the available experimental data of Sparrow et al. (1967) and Goldstein and Kreid (1967). The potential of PNS equations in predicting laminar flow in a curved circular pipe was tapped by Patankar et al. (1974) using the scheme of Patankar and Spalding (1972). Their predictions show a very satisfactory agreement with the available experimental data of Mori and Nakayama (1965) and Austin (1971) and the theoretical solution of Akiyama and Cheng (1971). Thereafter, a number of investigators has followed the works of Patankar et al. (1974) and even extended the use of PNS equations to developing flow in curved rectangular ducts.