Numerical Findings on the Boundary Layer Transition of Critical-Flow Venturi Nozzles

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Presently available information on the boundary layer transition of CFVN (critical flow venturi nozzles) depends only on experimentally measured discharge coefficient variation with Reynolds (Re) number. The investigations reported here aims to add, fluid flow details information of CFVNs transition phenomena, to the existing knowledge for better understanding of the problem. Previous investigations of the authors have shown that various features, of CFVNs, such as discharge coefficient variation with Re number, conjugate heat transfer and flow instability, can be studied numerically by commercial CFD (computational fluid dynamics) packages and numerically obtained results were in good agreement with those of available corresponding experimental cases. For the present investigations, the new turbulence models which have the capability to predict the boundary layer transition were used to simulate the transition occurring within CFVNs. Series of simulation cases were performed for various Re numbers and nozzle diameters. Presently obtained results indicated that transitional boundary layer can be captured numerically and the comparison of discharge coefficient variation with Re number with the available experimental data is fairly in good agreement. In the final paper, in addition to discharge coefficient dependence to Re number, some flow field details will be presented and comparisons would be made with corresponding available experimental cases.