Numerical Study for the Turbulent Flow in High Incidence Compressor Cascade

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Abstract

A numerical analysis based on two-dimensional and three-dimensional incompressible Navier-Stokes equations has been carried out for double-circular-arc(DCA) compressor cascades. Two types of double-circular-arc cascades which were initially used in previous experiment were used in this analysis. The appropriate turbulent model for compressor analysis was selected among the some conventional turbulence models such as Baldwin-Lomax, $k-\varepsilon$ and $k-\omega$ models. The results of current study are compared with available experimental data at various incidence angles. The 2-D and 3-D computational codes based on SIMPLE/PWIM algorithm for collocated grid and hybrid scheme for the convective terms were the main features of numerical tools. As commonly known, turbulence modeling is very important for the prediction of cascade flows, which are extremely complex with separation and reattachment by adverse pressure gradient. For selection of turbulence model, 2-D analysis was performed. And then, $k-\varepsilon$ turbulence model with wall function chosen as the reasonable turbulence model for 3-D calculation is used to increase the efficiency of computation times. As a result, 3-D flow patterns passing through the double-circular-arc cascade were reasonably investigated.

Keyword: *DCA, cascade, incidence angle, SIMPLE/PWIM*