Assessment of Modern RANS Models for the C3X Vane Film Cooling Prediction

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Abstract : The paper presents the results of a detailed assessment of several modern Reynolds Averaged Navier-Stokes (RANS) turbulence models for prediction of C3X vane film cooling at various injection regimes. Three models are considered, namely the Shear Stress Transport (SST) model, the modification of the SST model accounting for the streamlines curvature (SST-CC), and the Explicit Algebraic Reynolds Stress Model (EARSM). It is shown that all the considered models face with a problem in prediction of the adiabatic effectiveness in the vicinity of the cooling holes; however, accounting for the Reynolds stress anisotropy within the EARSM model noticeably increases the solution accuracy. On the other hand, further downstream all the models provide a reasonable agreement with the experimental data for the adiabatic effectiveness and among the considered models the most accurate results are obtained with the use EARMS.