Criteria-based Intermittency Transition Model Implementation and Application to 3D Turbine Cascade

Petr Louda, Kozel Karel
Czech Technical University in Prague
petr.louda@fs.cvut.cz, karel.kozel@fs.cvut.cz

Prihoda Jaromir
Institute of Thermomechanics in Prague
prihoda@it.cas,cz

Abstract

The work deals with numerical simulation of transonic flow through turbine cascade where the effect of transition to turbulence is taken into account. The turbulent stresses are modelled using an explicit algebraic Reynolds stress model (EARSM) with two-equation γ-ζ intermittency transiton model proposed by Dick and co-workers. In the model, empirical transition criteria for transition in attached as well as separated state are employed. This gives the model high reliablity but at the same time presents some difficultiies for application of the model especially in the 3D geometry and in parallel computing environment since the criteria are not local. In this work the criteria are re-formulated in order to be local in streamwise direction and the non-local parameters are computed in the wall-normal direction only. Within the framework of multi-block finite volume solver, the formulation is then block-local under assumption the thickness of boundary layer is contained in 1 block. This can usually be fullfilled. The results are shown for 3D mid-section turbine blade with side-walls. The results are compared with measuremnt data for cases including transition in attached state as well as for transition on separation bubble.

References

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