Numerical model of transonic wind tunnel test section

Petr Louda Jaromír Příhoda Jiří Fürst

Czech Technical University in Prague/ Institute of Thermomechanics, Czech Academy of Sciences

petr.louda@fs.cvut.cz

The authors consider computational model of transonic wind tunnel test section which is based on averaged Navier-Stokes equations solved by a finite volume method. Flow over models of various turbine cascades is considered. Depending on geometry of the cascade and the flow conditions, parasitic wave structures appear in measurements. As a counteract, perforated tailboards are placed after the cascade to improve periodicity of the flow and diminish wave reflections from tunnel walls or shear layers. For the same reason, parts of the tunnel wall upstream of the cascade are ventilated or a suction is applied. In the 2D numerical model, the perforated boards or wall can not be simulated and a model is needed. Authors selected the Bohning-Doerffer (B/D) model and calibrated the model porosity coefficient using numerical simulations of flow over 3D perforated plates. The results od 2D simulations are compared with measurements carried out in the wind tunnel facility of the Institute of Thermomechanics, Czech Academy of Sciences. It is shown that the 2D model can provide relevant results which contribute to understanding of the origin of various parasititic wave structures caused by tunnel boundaries and shear layers behind the cascades.