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Conjugate Heat Transfer Analysis of a High Loaded Convection Cooled Turbine Vane with STAR-CCM+

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The importance of coupled simulations of aerodynamics and heat transfer in the development of stationary gas turbines and aero engines is growing steadily in order to minimize development costs and effort. Conjugate heat transfer calculations can reduce those efforts and cost significantly, e.g. by reducing the quantity of experimental tests. As a result, the quality of numerical results becomes an important issue. In addition, due to more and more complex models, the set-up and validation of the numerical calculations is also of high importance.

This presentation will show the set-up and validation of a conjugate heat transfer calculation of a high loaded convection cooled turbine vane with STAR-CCM+. A NASA test case called ?Mark II? was used as a validation test case for evaluation of numerical solutions methods for the conjugate heat transfer calculations. The influence of different numerical models for turbulence calculations and the validation of the gamma Re theta transition model will be presented. The numerical results are discussed and compared with the experimental results of the test case.

This work shows that the conjugate calculation approach in STAR-CCM+ is of high value in the modern design of extensively cooled turbine vanes and blades.

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