Conjugate Heat Transfer on a Gas Turbine Blade

Clearances between gas turbine casings and rotating blades is of quite importance on turbo machines since a significant loss of efficiency can occur if the clearances are not predicted accordingly. The radial thermal growth of the blade may be over or under predicted if poor assumptions are made on calculating the metal temperatures of the surfaces exposed to the fluid. The external surface of the blade is exposed to hot gas temperatures and it is internally cooled with air coming from the compressor. This cold air enters the radial channels at the root of the blade and then exists at the tip. To obtain close to realistic metal temperatures on the blade, the Conjugate Heat Transfer (CHT) approach would be utilized in this research. The radial thermal growth of the blade would be then compared to the initial guess.

This work focuses on the interaction between the external boundary conditions obtained from the commercial Computational Fluid Dynamics software package CFX, the internal boundary conditions along the channels from a 1D flow solver proprietary to Siemens Energy, and the 3D metal temperatures and deformation of the blade predicted using the commercial Solid Mechanics software package ANSYS.

An iterative technique to solve CHT problems is demonstrated and discussed. The results of this work help to highlight the importance of CHT in predicting metal temperatures and the implications it has in other aspect of the gas turbine design such as the tip clearances.

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The public is welcome to attend.