AxSTREAM SYSTEM SIMULATION

Gas Turbine Secondary Cooling Flow Path Modeling

Case Study Summary

Goals:

Estimate the pressure and velocity distributions in a secondary flow path with given boundary conditions. Analyze the swirl momentums in the rotor-stator centrifugal cavities. Evaluate the system's heat transfer.

Requirements:

Estimate the possible choked flows in the system.

Parameters:

P* behind the compressor - 1.414 MPa;
T* behind the compressor - 200 ºC;
Pst at the hot flow path - 0.826 MPa;
Geometry data of the cooling path is determined.

Constraints:

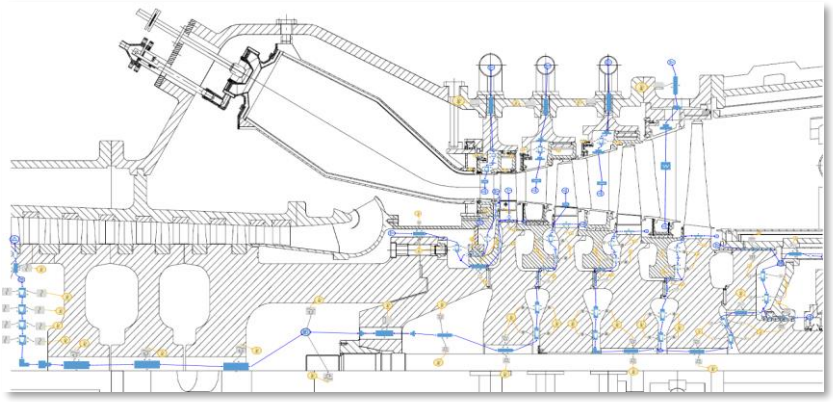
Allowed temperature gradients for the disks

Results of the Study:

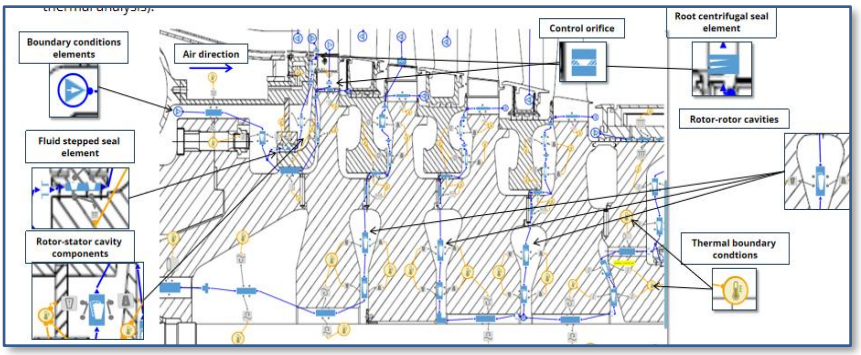
An accurate and detailed domain discretization approach was used to predict the cooling flow path pressures, temperatures, and velocities. Heat transfer coefficients were determined using built-in criteria correlation methods.

Secondary Flow Path Design

The design and verification calculation of complex secondary flow paths includes evaluating the flow and leakages through cavities, seals, orifices, etc. These sections influence the flow, creating resistance and pressure losses. The airflow in the system is swirled and has an absolute velocity with a tangential component.



The thermal boundary conditions aid in determining the heat transfer coefficients using criteria correlations typically utilized in thermal analyses.



Taking into consideration the full development process of a cooled gas turbine, users can integrate tools from other areas of the design process such as:

- AxSTREAM for compressor and turbine design
- 3D FEA for stress prediction
- AxSTREAM System Simulation to model the GT thermodynamics cycle

The automatic iteration enables complete machine design while considering changes in cooling flow exhaust from the compressor, a better understanding of the influence of flow path parameters in both the turbine and compressor, and changes in thermal stresses through all working regimes.