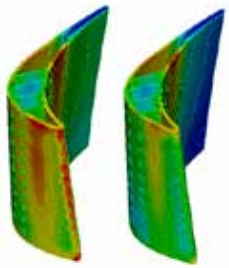
Concepts NREC

The Experts in Turbomachinery

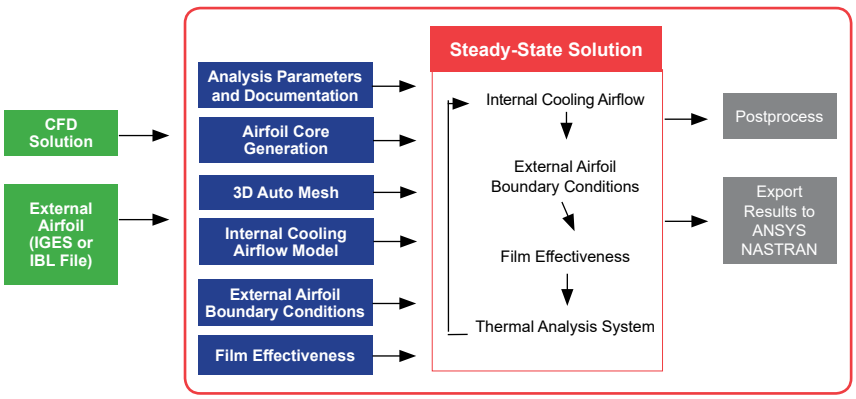


Cooled Turbine Airfoil Agile Design System

CTAADS™

CTAADS is a systematic, logical, and rapid 3D modeling approach to cooling-system design for cooled axial turbine vanes and blades. The system includes many special features that can significantly reduce the total time and cost for designing cooled turbine airfoils.

- Integrated suite of independent software modules
- Efficient data transfer and sharing complete 3D thermal analysis including film holes, impingement holes, trailing edge exit slots, pedestals, and thermal barrier coating
- 3D airfoil model represented with geometric finite elements
- Fast finite difference thermal solver
- User-defined pressure loss and heat transfer correlations (for internal cooling airflow model)
- User-defined film effectiveness curves



CTAADS System Schematic

Basic System Components

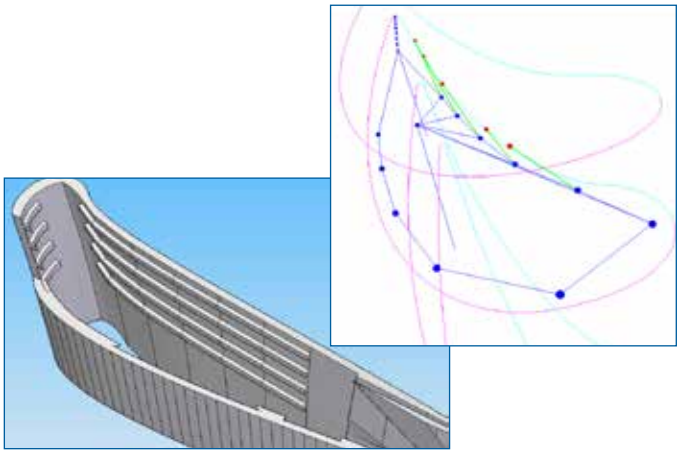
- Airfoil core and 3D solid-model generation
- Automatic 3D mesh generation
- Internal cooling airflow model
- External airfoil boundary conditions
- Film effectiveness
- Automatic boundary conditions mapping
- Steady-state thermal analysis
- Postprocessing

3D Visualization of Internal Flow Network

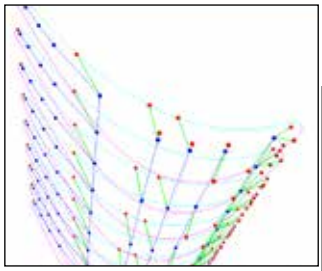
The internal flow network can be visualized in 3D space relative to the cored airfoil, with node and branch information being viewed on the same network, after the “Construct Definition” is executed. The radial flow network shows the internal nodes, boundary nodes, stagnation points, internal branches and Airfoil PS & SS wall contours in different colors for easy identification.

External Flow Solver

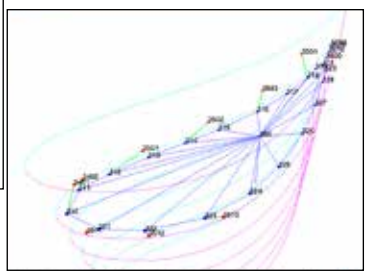
Users can specify a uniform initial external airfoil wall temperature. However, once the steady-state module is started in CTAADS, external wall temperatures are read from the thermal model and the initial estimates no longer apply.



Axial Riblet (left), and model view of cooling on one side of airfoil (right).



3D View of Radial Flow Network



3D View of Impingement Flow Network

New Cooling Features

Users can model axial riblets that act as axial channels and cooling fans, for single impingement type cooling configurations which will wrap around the airfoil internal wall and break before the TE cooling feature starts. Riblets can be discontinued at LE to allow radial flow. Staggered and inline impingement hole arrangements for single and double impingement type cooling configurations are also available, as well as configurations with impingement cooling on only one side of the airfoil tube (either on PS or SS), and a meter plate on cooling air supply network.

Concepts NREC's Agile Engineering Design System®		Radial				Axial			
		Compressors	Fans	Pumps	Turbines	Compressors	Fans	Pumps	Turbines
CAE Preliminary Design									
Meanline Approach	AXIAL™					✓			✓
Meanline Approach	COMPAL®	✓							
Meanline Approach	FANPAL™		✓				✓		
Meanline Approach	PUMPAL®			✓				✓	
Meanline Approach	RITAL™				✓				
CAE Detailed Design									
3D Geometric Design	AxCent®	✓	✓	✓	✓	✓	✓	✓	✓
CFD Option for AxCent	FINE™/Turbo™*	✓	✓	✓	✓	✓	✓	✓	✓
Pre- & Post-Processor for AxCent	ipsPost™	✓	✓	✓	✓	✓	✓	✓	✓
FEA Option for AxCent	Pushbutton FEA™	✓	✓	✓	✓	✓	✓	✓	✓
CAE Specialized Design Software									
Gas Turbine Blade Cooling	CTAADS™								✓
Optimization	TurboOPT II™	✓	✓	✓	✓	✓	✓	✓	✓
Rotor Dynamics	Dyrobes®	✓	✓	✓	✓	✓	✓	✓	✓
Gas Turbine Cycle Analysis	GasTurb®	✓				✓			✓
CAM Toolpaths									
Base Platform	MAX-PAC™	✓	✓	✓	✓	✓	✓	✓	✓
Flank Milling Option	MAX-5™	✓	✓	✓	✓	✓	✓	✓	✓
Point Milling Option	MAX-AB™	✓	✓	✓	✓	✓	✓	✓	✓
Closed Impeller Option	MAX-5I™	✓	✓	✓	✓	✓	✓	✓	✓
Single Blade Option	MAX-BB™	✓	✓	✓	✓	✓	✓	✓	✓
3+2 Roughing Option	3+2 Roughing	✓	✓	✓	✓	✓	✓	✓	✓

*Offered in partnership with NUMECA International® as part of the FINE/Agile™ integrated suite.

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