

NX Advanced Thermal

fact sheet

Siemens PLM Software

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► Summary

NX® Advanced Thermal software extends the modeling and simulation capabilities in NX Thermal to include advanced radiation effects, diurnal environmental solar heating, Electrical (Joule) heating, material phase changes, thermal ablation, charring and duct flow heat transfer. NX's heat transfer modeling capabilities can be explicitly combined with the NX's fluid dynamics (CFD) solutions to allow a user to simulate strong and fully-coupled thermo-fluid interactions problems. Resulting temperature results can also be mapped to a separate Nastran finite element model for thermo-elastic analysis.

Benefits

NX Advanced Thermal provides advanced thermal analysis solutions for many industries, including:

- Aerospace
- Automotive and ground transportation
- Civil and environmental engineering
- Consumer products
- Defense
- High tech and electronics
- HVAC
- Industrial and manufacturing processes
- Lighting and electro-optic equipment
- Machinery
- Marine and offshore
- Medical equipment and biomedical
- Oil and gas
- Power generation and nuclear
- Space
- Telecommunications

NX Advanced Thermal extends all of the capabilities in NX Thermal and provides additional capabilities in areas such as simulating duct flow, radiative heating and Joule heating

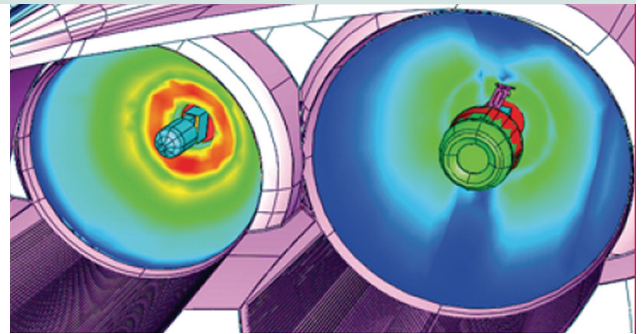
NX Advanced Thermal solves practical engineering performance simulation challenges such as:

- Aero-heating (may require NX Advanced Flow)
- Phase change and thermal ablation
- Thermal behavior in high speed rotating equipment
- Joule heating under various electrical loads
- Laser system with ray-tracing
- Thermal refraction in optical and other participating media
- IR signature of large system in different environment settings
- Diurnal environmental solar heating (including cloud effects, altitude effects, longitude and latitude effects, object orientation, pollution effects, etc.)
- Implicit correlation-based free and forced convection heat transfer
- Hydraulic network heat transfer
- Specular, transmissive surfaces and other advanced radiation heat transfer applications

Multi-physics enablers

Robust thermo-fluid coupled solutions. NX Flow and NX Advanced Flow can be seamlessly coupled to NX Thermal and NX Advanced Thermal for simulation of complex thermo-fluid interactions and conjugate heat transfer. This multi-physics coupling capability is included at no extra cost and no additional licenses are required other than the NX Flow, NX Thermal and optionally NX Advanced Thermal licenses. The thermo-fluid solver handles disjoint meshes at fluid/solid boundaries allowing great flexibility in assembly context thermo-fluid interactions. The fluid domain and thermal domain do not need to share nodes at the interface; the coupled solver will create the appropriate heat transfer coupling at all the solid/fluid interfaces.

The NX Advanced Thermal solution can be used as a pre-stress condition for a structural thermo-elastic analysis. The NX Nastran or structural solver license is sold separately.



Features

Multi-layer shell

Additional material and optical properties:

- Electrical resistivity
- Phase change and ablation properties
- Extinction coefficient
- Refraction
- Bi-variate tables
- Transmissivity/specularity
- Angle dependent optical properties

Additional thermal couplings for advanced assembly context modeling:

- Join
- One Way heat transfer
- User defined
- Connection break or Series or T-junction
- Free and forced correlation-based convection couplings

I-D duct and hydraulic network elements

Additional radiation request types

- Among group
- Group to group
- Monte Carlo calculation method
- Enhanced radiation with Ray Tracing

Radiation patch controls

Articulation and motion modeling (any combination of translational motion and rotational joints)

Diurnal heating

- Account for shadowing
- Correlation for solar flux taking into account altitude
- Multiple solar vectors, or a single one, combined with a variable solar flux

Radiative heating

Peltier coolers modeling

Joule heating

Thermostats PID controllers

Open Architecture (user subroutines)

Restarts (Advanced controls)

Support to include external files

Industry solutions

The following is a list of common industry-specific problems that can be solved by the NX Advanced Thermal software (some applications require both NX Flow and NX Advanced Flow):

Aerospace

- Aero-heating and ablation modeling
- High speed rotating equipment thermal effects modeling
- Multi-layer thermal insulation blanket design
- Aircraft brake thermo-fluid design
- Engine exhaust systems thermo-fluid analysis
- Cabin heating and ventilation simulation
- Aircraft electronics systems cooling strategy investigations
- Articulation and motion modeling of different hydraulic systems
- Diurnal solar heating of cabin
 - Account for shadowing
 - Correlation for solar flux taking into account altitude
 - Multiple solar vectors, or a single one, combined with a variable solar flux

Automotive and ground transportation

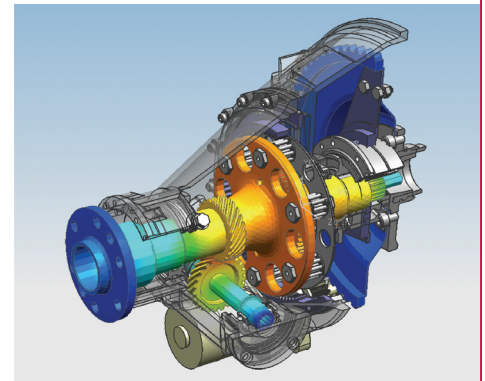
- Engine cooling
- Radiator sizing
- Thermal management of automotive electronic systems
- Headlamp and lighting cooling analysis
- Headlamp hot spot and melting spot prediction
- LED light active cooling simulation
- Electric motor and drive thermal management systems
- Exhaust manifold and underbody thermal issues
- Clutch and transmission cooling
- Heating effects on tanks and fuel supply systems
- Brake systems thermo-fluid design
- Heating and ventilation (passenger cabin HVAC)

Civil and environmental engineering

- Planning and simulation of building HVAC systems
- Building thermal comfort assessments
- Medical units and patient thermal comfort
- Nuclear plant HVAC

Consumer products

- Electrical heating of different components
- Oven, radiative heater elements and other heater detailed analysis
- Product air or fluid circulation performance analysis
- Complex shape product parts and assembly thermo-fluid performance simulation
- Cooling strategies investigations
- Avoiding hot spots and recirculation areas



Defense

- IR signature modeling and simulations
- Laser (with ray-tracing) and opto-mechanical devices thermal design and analysis
- Extreme environmental conditions modeling – including diurnal solar heating taking into account cloud effects, longitude and latitude effects, vehicle orientation, pollution level, etc.
- Thermo-fluid camouflage applications
- Aero-heating and ablation modeling
- Aircraft brake thermo-fluid design
- Engine exhaust systems thermo-fluid analysis
- Cabin heating and ventilation simulation
- Defense vehicle electronic systems cooling strategy investigations
- Articulation and motion modeling of different hydraulic systems
- Diurnal solar heating of cabin
 - Account for shadowing
 - Correlation for solar flux taking into account altitude
 - Multiple solar vectors, or a single one, combined with a variable solar flux

High tech and electronics

- Determining electronic systems cooling strategies
- Enclosures, subsystems, power supplies thermal management
- PC boards, multi-chip modules detailed thermal design
- Critical components placement
- Heat sinks modeling
- Detailed board level analysis, including joule heating
- Spacing requirements between critical parts
- Identifying recirculation areas and hot spot issues

HVAC

- PPD and PMV thermal comfort standard calculations
- Automotive and ground transportation cabins thermal comfort
- Aircraft and airborne vehicles thermal comfort
- Building thermal comfort
- Submarine HVAC
- Medical units and patient thermal comfort
- Nuclear plant HVAC
- Duct air distribution systems
- Heat exchangers design and analysis

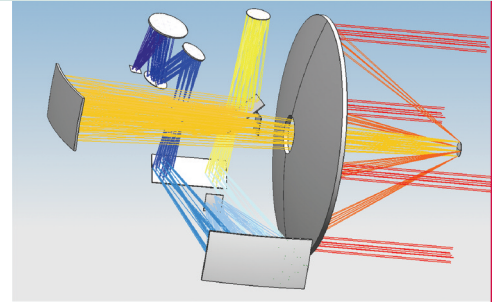
Industrial and manufacturing processes

- Manufacturing processes simulation (drying stage, a heating or cooling station stage)
- Preventing and/or troubleshooting operational failure due to heat problems (melt spots, running hot, performance degradation due to operating temperature, etc.)
- Heating/cooling systems or sub-systems component sizing
- Temperature critical components analysis

- Hydraulic systems analysis
- Hot water pipe heating systems design and analysis
- Instrumentation/sensors/optics operational thermal condition simulation

Lighting and electro-optic equipment

- Melt spots prediction
- Determining cooling strategies
- Lighting system material selection
- Detailed design and analysis of radiative filament component
- Test data validation
- Troubleshooting operational thermal-related failures
- Automotive headlamps thermo-fluid analysis
- Instrument clusters and gauges thermo-fluid management
- LED light active cooling simulation
- Multimedia projectors thermo-fluid analysis
- Digital display systems thermal simulation
- Commercial and theatrical lighting systems analysis



Machinery

- Thermal management of machinery electronics
- Cabin HVAC simulation
- High speed rotary machinery thermo-fluid analysis
- Thermal heat shields design and analysis
- Instrument clusters and gauges thermal management

Marine and offshore

- HVAC cabin systems design (PPD and PMV thermal comfort standard calculations)
- On-board electronic equipment cooling strategies investigation
- Hydraulic networks and heat exchangers simulations
- Water and gas supply systems simulations

Medical equipment and biomedical

- Thermal analysis of X-Ray tube assemblies
- Thermal management of medical electronic systems
- Patient thermal comfort HVAC

Power generation and nuclear

- Fuel rod bowing (coupled thermal-structural using temperature mapping, requires NX Nastran)
- Computing flow distribution in reactor core (fully coupled 3D/1D flow models)
- Thermal management of critical electronic systems
- Nuclear plant HVAC

Oil and gas

- Preventing and/or troubleshooting operational failure due to heat problems (running hot, performance degradation due to operating temperatures, etc.)
- Heating/cooling systems or sub-systems component sizing
- Temperature critical components analysis
- Hydraulic systems analysis
- Pump systems analysis (including slurry pump calculations)
- Hydraulic networks and heat exchangers simulations
- Instrumentation/sensors/optics operational thermal condition simulation

Space

- Loop heat pipes analysis
- Multi-layer thermal insulation blanket design
- Fluid pulse-driven cryo-coolers
- Space test-bed experimental apparatus thermo-fluid analysis
- Space station and future space modules HVAC

Telecommunications

- Determining telecommunication system cooling strategies
- Enclosures, antenna subsystems, power supplies thermo-fluid analysis
- Telecommunication critical components placement
- Heat sinks design and material selection
- Spacing requirements between critical parts
- Identifying recirculation areas and hot spot issues

Supported hardware/OS

NX Advanced Thermal is an add-on module in the NX Advanced Simulation suite of applications. It requires a license of NX Thermal as a prerequisite. All standard NX hardware/OS platforms are supported (including Windows, Linux, Unix and selected 64-bit platforms). Contact Siemens for any other specific hardware/OS support requests.

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