NX Electronic Systems Cooling: Thermo-fluid analysis for electronics

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Benefits

- Simulate 3D air flow and thermal behavior in electronic systems
- Perform digital thermal simulation early in the design process, reducing the need for building and testing physical prototypes
- Integrate analysis with mechanical engineering and design for guidance, not just verification
- Minimize tedious rework and modeling errors with direct interfaces to ECAD systems
- Display simulation results to gain physical insight and optimize design

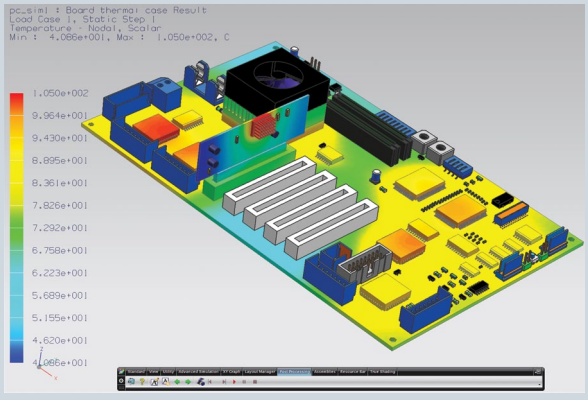
Summary

NX™ Electronic Systems Cooling software is an industry-specific vertical application that leverages the NX Flow and NX Thermal solvers as well as the NX PCB Exchange capabilities in an integrated multi-physics environment to simulate 3D air flow and thermo-fluid behavior in densely packed, heat sensitive electronic systems. NX Electronic Systems Cooling helps resolve thermal engineering challenges early in the design process and is a valuable aid in understanding the physics of fluid flow and heat transfer for electronic enclosures.

Product description

NX Electronic Systems Cooling continues Siemens' long heritage in thermal simulation and leverages the same technology that underpinned the I-deas TMG solution. NX Electronic Systems Cooling is ideal for modeling and analyzing electronics cooling applications with complex 3D design geometry. As an integral part of the complete NX digital product development suite, the NX Electronic Systems Cooling solvers enable you to effectively use simulation to provide design guidance early in the design cycle, not just final design verification.

Modeling of complex 3D assemblies is made easy with the integrated NX Advanced FEM capabilities (a prerequisite for NX Electronics Systems Cooling). No additional input files or geometry conversions are needed to build your coupled thermo-fluid models. NX provides a distributed model approach to assembly analysis whereby the Assembly FEM model does not contain the component FEM models, but instead holds pointers to these models. Assembly FEM enables a more efficient process for building large models comprised of multiple



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NX Electronic Systems Cooling

components. NX Design Freedom powered by Synchronous Technology enables users to modify geometry by easily moving or deleting individual faces or features such as bosses or ribs. Synchronous technology empowers analysts to make simple changes to geometry to support what-if analyses thereby speeding up design-analysis iterations. Furthermore, this technology works with native and imported geometry, both with or without history.

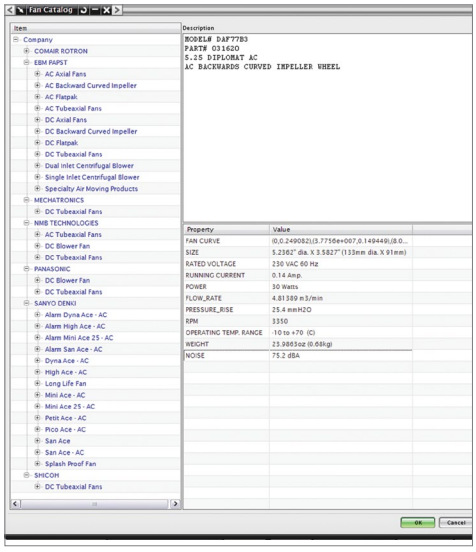
The NX Electronic Systems Cooling package includes NX PCB Exchange, a bi-directional interface to EDA design systems for the direct use of PCB and FPC data. With NX PCB Exchange, fully three-dimensional board designs can be obtained from the leading PCB and FPC layout software packages, including:

- Zuken
- Mentor Graphics
- Cadence
- Altium

Industry applications

The thermal performance simulation capabilities of NX Electronic Systems Cooling can be leveraged to meet the electronics product design requirements for virtually all industries. Typical electronic systems cooling applications include:

- Determining electronic systems cooling strategies



- Enclosures, subsystems, power supplies thermal management
- PC boards, FPCs, multi-chip modules detailed thermal design
- Critical components placement
- Heat sink modeling
- Spacing requirements between critical parts
- Predicting fan operating conditions
- Volume and mass flow estimations
- Computing pressure inlet/outlet gradients and head losses
- Identifying recirculation areas and hot spot issues

Specific capabilities for electronic systems simulation

- Fan catalog (database of fan curves) with more than 2000 fans from leading manufacturers
- Thermal control models:
  - Thermostats, active heater controllers, fan controllers
  - PID Peltier cooler modeling
- Electrical component modeling (two-resistor models with automatic temperature reporting)
- Joule heating
- Modeling of layered printed circuit boards with spatially varying thermal properties

Board Thermal Analysis

NX PCB Exchange can be used to automatically generate board thermal models, ready to be solved using NX Electronics Systems Cooling. Users can control the default component parameters, board mesh size and color, and environmental conditions. By pointing to a user-database of component thermal properties, NX PCB Exchange creates a suitable model for each electrical component. PCB Exchange uses copper trace data imported from ECAD to compute and apply detailed conductive properties to the board thermal models.

Core simulation capabilities

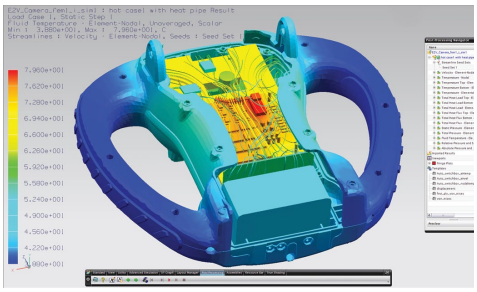
- 3D CFD Navier-Stokes and solid heat conduction
- Steady-state and transient analysis
- Turbulent (k-E, mixing length), and laminar flows
- Internal and external flows
- Buoyancy and altitude effects
- Multiple fluid enclosures with distinct fluids
- Radiation enclosures using hemicube-based view factor calculations (using graphics card hardware)
- Parallel processing (3D flow calculations, radiation view factors)
- Up to eight solver processes per analysis on a single machine
  - Unlimited processes across multiple machines with NX Thermal/Flow DMP add-on

Meshing

- Supports all combinations of tetrahedral, brick, wedge and pyramid element types
- Complete set of automatic and/or manual meshing options for the selected fluid domains
- Automatic skin mesh (boundary layer mesh) with multiple layers
- Automatic connection between disjoint fluid meshes
- Disjoint thermal/fluid meshes support in assembly modeling
- Surface wrapping technology for generating fluid domains in complex assemblies

Boundary and interface conditions and imposed loads

- Vent and fan definitions: fan curves can be defined
- Head loss inlets and openings (fixed or velocity dependent)
- Fluid swirl at inlet and internal fans
- Fluid recirculation loop models
- Constant, time and spatially-varying heat loads and temperature constraints



- Losses in fluid flow due to screens, filters and other fluid obstructions (including orthotropic porous blockages, packed beds and fibrous media), local laminar flow in porous blockage
- Thermal couplings (welded, bolted, bonded, etc) for assembly modeling with potential for spatially varying heat transfer coefficients
- Forced and natural convection enhanced wall functions

Solver control

- Solution intermediate results recovery allowing solver restart
- 10 choices of units at run-time
- Coupled fluid-thermal solver control

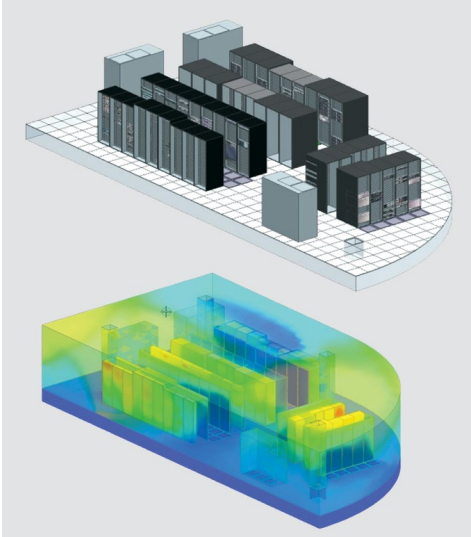
Postprocessing

- Thermal and flow data tracking and plotting at run-time
- Streamlines, ribbons and bubbles post-processing display
- Mapping of pressures, shear forces and temperatures to structural models with dissimilar mesh

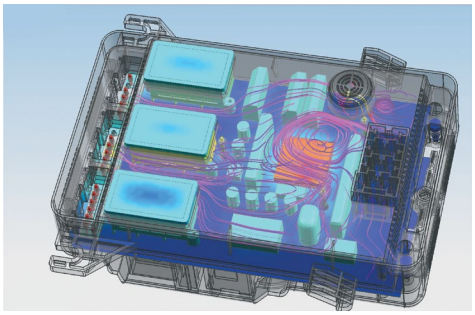
Additional add-on solutions:
NX Electronic Systems Cooling can be combined with the NX Advanced Thermal and NX Advanced Flow product to add-on:

- Advanced capabilities of radiation, ideal for thermal problems in lighting applications
- Advanced flow features like scalars, humidity and heavy particle tracking, single and multiple rotating frames-of-reference, additional turbulence models, 1D duct networks
- Environmental solar heating models (including atmospheric and positional effects)
- Open architecture with access to thermal system equations and importing of external models

Supported hardware/OS
NX Electronic Systems Cooling is an add-on module in the NX Advanced Simulation suite of applications. All standard NX hardware/OS platforms are supported (including Windows, Linux and selected 64-bit platforms). Contact Siemens for any other specific hardware/OS support requests.



Thermal-flow analysis within a data center.



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