Multi-disciplinary integrated analysis solution for optimal design

midas NFX **2021R1 Enhancements**

midas NFX
Release Note

2021 R1

Major Updates

- CAD Interface update
- Shape memory alloy
- Complex mode analysis
- Nonlinear prestressed analysis
- Solar heat wall
- Thin plate model

midas NFX provides complete integration/linked analysis of structure/heat/fluid/optimization using a single model in a single work environment and a familiar environment for designers and systematic education and technology through a windows-based GUI.

In midas NFX 2021 R1, we strived to improve product performance and stability and increase user convenience. We promise to provide a variety of convenient functions to establish ourselves as a reliable partner in the future.

CAD Interface Update

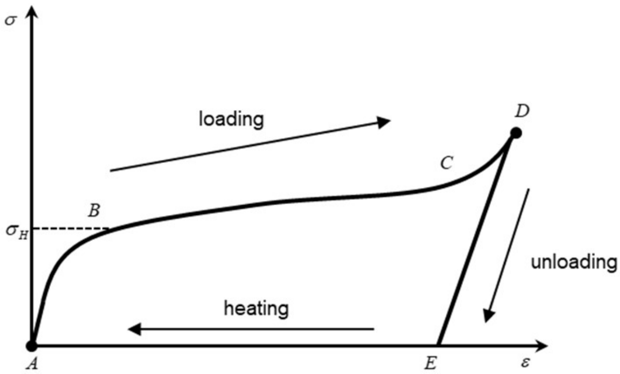
The CAD Interface was updated according to the CAD Version update. Support for the latest version of CAD Interface may be delayed depending on the supplier's update environment. If the newest version is not supported, please convert it to Parasolid or STEP file. We will do our best to reflect on the latest version of CAD quickly.

Type	Extension	Version
Parasolid	x_t, xmt_txt, x_b, xmt_bin _	9.0 ~ 33.0
ACIS	sat, sab, asat, asab	R1 ~ 2021.1.0
STEP	stp, step	AP203, AP214, AP242
IGES	igs, iges	Up to 5.3
Pro-E / Creo	prt, prt.*, asm, asm.*	16 ~ Creo 7.0
SolidWorks	sldprt, sldasm, slddrw	98 ~ 2021
CATIA V4	CATPart, CATProduct, cgr, CATDrawing	4.1.9 ~ 4.2.4
CATIA V5	CATPart, CATProduct, cgr, CATDrawing	V5 R8 ~ V5-6R2021
Unigraphics	prt	11 ~ NX1926
Inventor Part	ipt	V6 ~ V2021
Inventor Assembly	iam	V11 ~ V2021
SolidEdge	par, asm, psm	V18 ~ SE2021

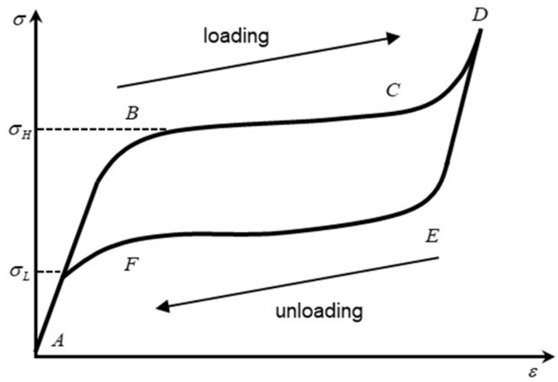
Shape Memory Alloy (Structural analysis)

< Purpose of development and method of use >

A shape memory alloy is a metal mixture that remembers the original shape before deformation. This occurs due to the interaction of two physical phenomena. The first feature is pseudo-elasticity, which means a large deformation without residual deformation in repetitive loading-unloading cycles at high temperatures. The second feature is the shape memory effect. The shape memory alloy with residual deformation at low temperatures recovers to its original shape before deformation through thermal cycles.

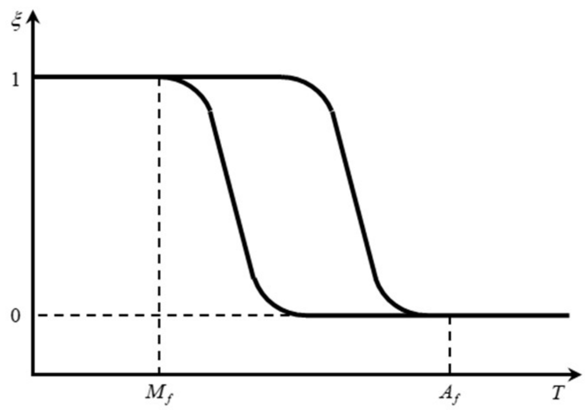


〈Pseudoelastic behavior at high temperature〉

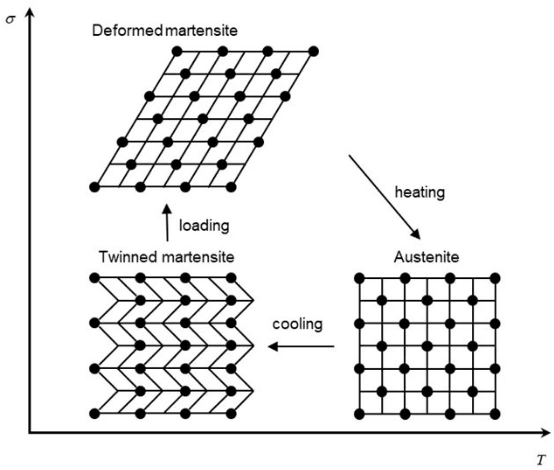


〈Shape memory effect at low temperature〉

This unique material behavior is due to the microstructural characteristics of the material, due to the phase transformation occurring between the denser austenite and the relatively less dense martensite. In general, austenite is stable under high temperature and low-stress conditions, while martensite is a stable crystal structure under low temperature and high-stress conditions. Due to the crystal structure characteristics, the phase change caused by changes in temperature and stress conditions causes pseudoelastic behavior and shape memory effects.



〈Martensite ratio according to temperature〉

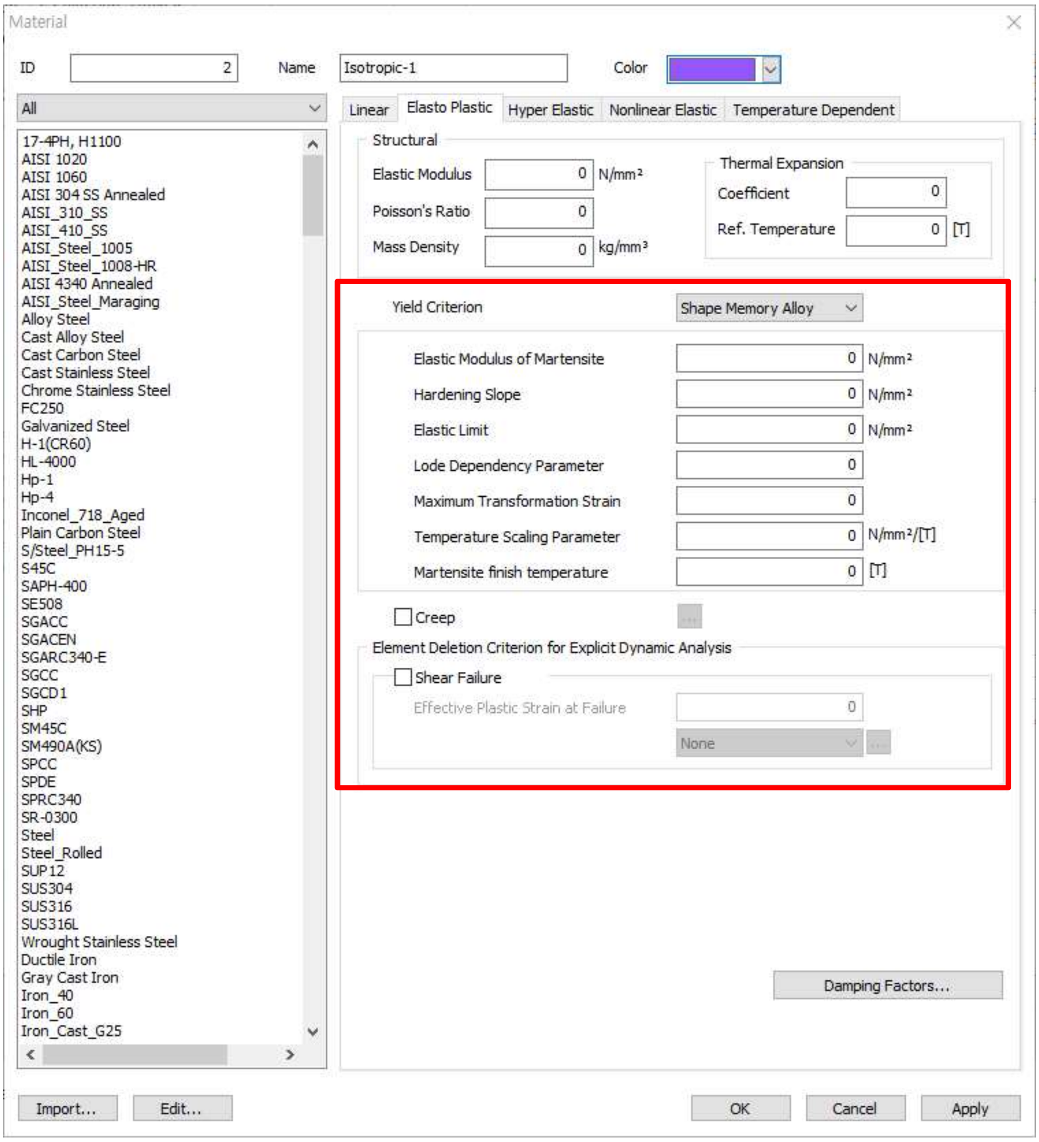


〈Phase change according to temperature and stress conditions〉

Shape Memory Alloy (Structural analysis)

The shape memory effect of shape memory alloy materials is based on a three-dimensional thermo-mechanical model of phase change based on heat and stress. This model is built on the theory of thermodynamics and can realize the main features of shape memory alloys under three-dimensional stress conditions.

In midas NFX, the shape memory alloy material can be applied by changing the yield criterion to Shape Memory Alloy in the elastoplastic material property value. Martensite's elastic tangential stiffness, maximum phase strain, and upper-temperature limit are used to define the material's free energy potential and apply it to the analysis.



〈 Shape memory alloy material interface 〉

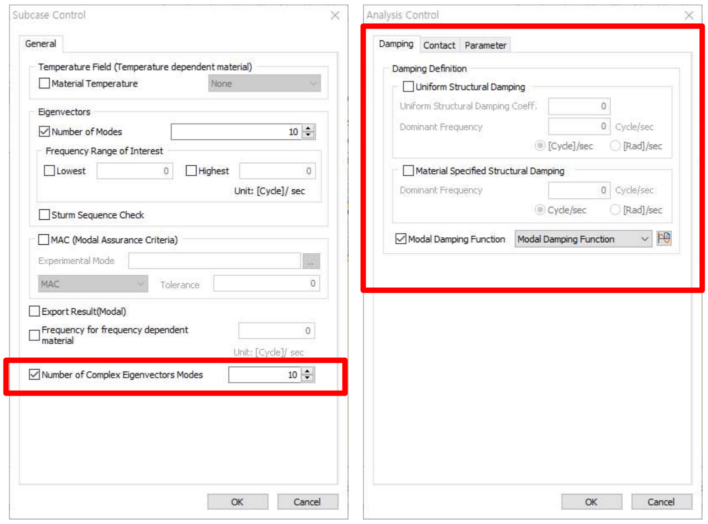
Complex Mode Analysis (Structural Analysis)

〈 Purpose of development and method of use 〉

In the conventional real eigenvalue solution, the mass/stiffness matrix is real and symmetric and can only be applied to models where the mass matrix satisfies the positiveness. The complex eigenvalue solution can be used to obtain an eigensystem with damping for eigenvalues and eigenvectors when the conventional eigenvalue solution cannot be applied in midas NFX.

The complex eigenvalue mode can be caused by dynamic instability due to various shape variables and frictional forces. It can be used for multiple physical effects such as aeroelastic flutter, acoustics, and rotating bodies and measures the damping effect of structures in the entire system in many fields such as aviation, ships, automobiles, and defense industries. Or it can be used to define system safety against physical phenomena such as friction and rotation.

In the complex mode analysis subcase control, you can additionally set the number of complex eigenvalue modes to review the real eigenvalue and the imaginary eigenvalue of the imaginary part. Besides, the damping effect of the structure can be added by defining the damping ratio in the analysis control.



〈Complex mode analysis interface〉

COMPLEX EIGENVALUES				
MODE NUMBER	EIGENVALUE REAL	EIGENVALUE IMAG	DAMPED FREQUENCY	DAMPING RATIO
1	-1.228206e+002	2.453339e+003	3.904611e+002	1.001252e-001
2	-1.228206e+002	-2.453339e+003	3.904611e+002	1.001252e-001
3	-1.541654e+003	3.079450e+004	4.901098e+003	1.001252e-001
4	-1.541654e+003	-3.079450e+004	4.901098e+003	1.001252e-001
5	-6.562246e+002	1.310808e+004	2.086215e+003	1.001252e-001
6	-6.562246e+002	-1.310808e+004	2.086215e+003	1.001252e-001
7	-2.117863e+003	4.230428e+004	6.732935e+003	1.001252e-001
8	-2.117863e+003	-4.230428e+004	6.732935e+003	1.001252e-001
9	-1.984765e+001	-3.964565e+002	6.309802e+001	1.001252e-001
10	-1.984765e+001	3.964565e+002	6.309802e+001	1.001252e-001
11	-2.692594e+003	5.378452e+004	8.560072e+003	1.001252e-001
12	-2.692594e+003	-5.378452e+004	8.560072e+003	1.001252e-001
13	-3.209808e+003	6.411587e+004	1.020436e+004	1.001252e-001
14	-3.209808e+003	-6.411587e+004	1.020436e+004	1.001252e-001
15	-1.067166e+003	2.131662e+004	3.392646e+003	1.001252e-001
16	-1.067166e+003	-2.131662e+004	3.392646e+003	1.001252e-001
17	-1.561541e+003	3.119176e+004	4.964323e+003	1.001252e-001
18	-1.561541e+003	-3.119176e+004	4.964323e+003	1.001252e-001
19	-3.396474e+002	6.784452e+003	1.079779e+003	1.001252e-001
20	-3.396474e+002	-6.784452e+003	1.079779e+003	1.001252e-001

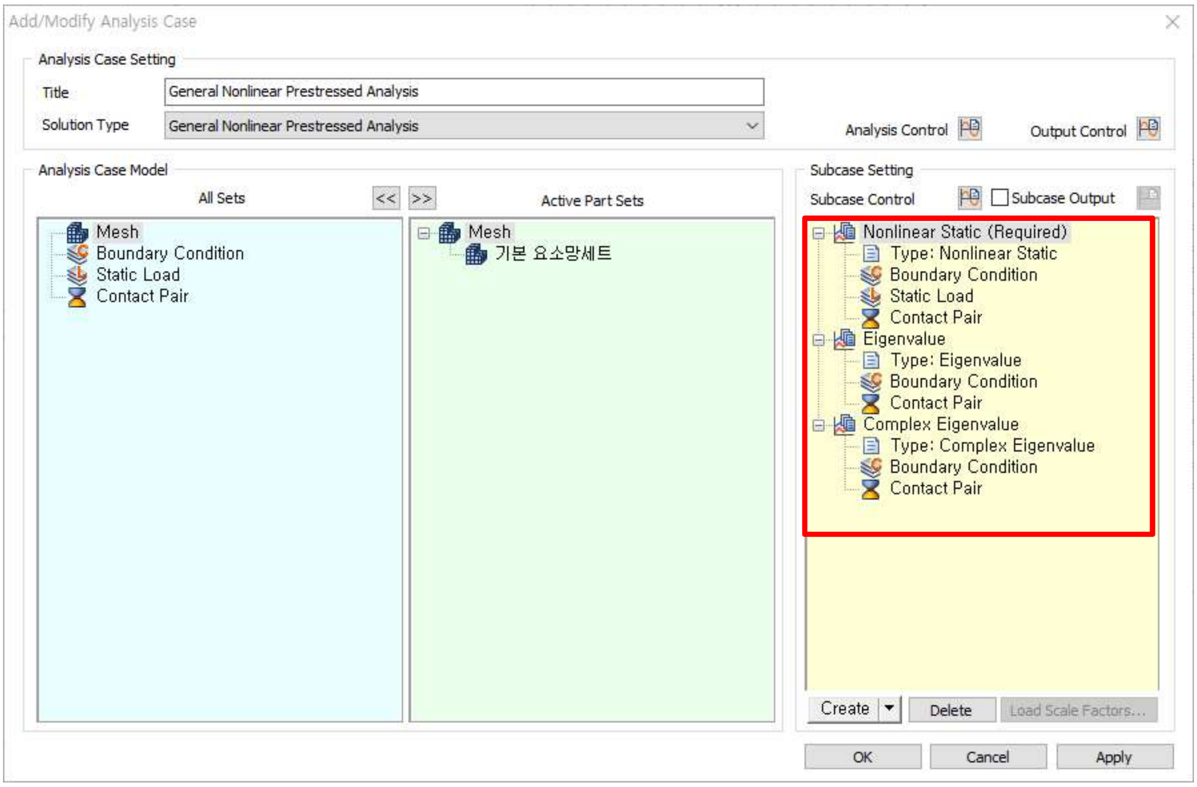
〈Complex mode analysis result table〉

Nonlinear Prestressed Analysis (Structural Analysis)

< Purpose of development and method of use >

Through General Nonlinear Prestressed Analysis, initial load results can be reflected in stiffness and applied to Modal Analysis or Complex Modal Analysis.

Various shape variables, boundary conditions, and damping effects are considered in complex mode analysis, but stiffness change due to initial load cannot be considered. To compensate for this, nonlinear prestress analysis has been added, and if necessary, analysis can be performed by selecting mode analysis and complex mode analysis and adding subcases. In this analysis, the stiffness of the sub-case present at the top marked as (Required) or (required) is applied to each sub-case, and it is possible to perform one analysis of multiple sub-cases by changing the damping effect and analysis conditions.



<Nonlinear Prestressed Analysis Interface>

Solar Heat Wall (CFD)

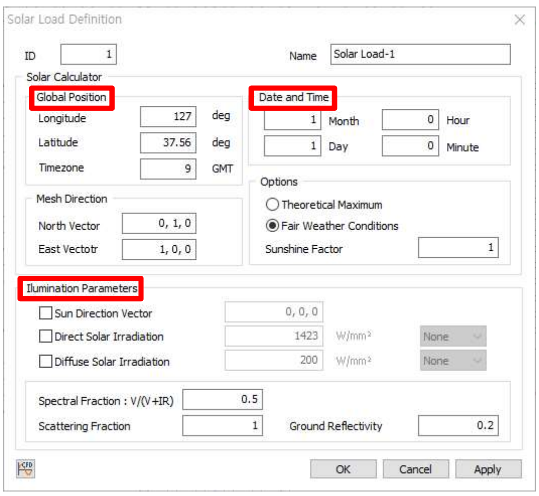
〈 Purpose of development and method of use 〉

When the object to be analyzed is directly exposed to sunlight, the analysis result will differ depending on the location, date, and time. It is possible to analyze the radiation effect by directly inputting the external heat flux, temperature, etc., to the wall boundary conditions. However, it is difficult to correctly set the conditions due to the complicated state of actual sunlight, such as the heat flux value by date or time or the direct solar heat flux. Also, the obtained results are quite different when compared to actual experimental results. midas NFX provides a solver for the solar model to correctly input the radiation effect from sunlight, helping you perform faster, easier, and more accurate analysis.

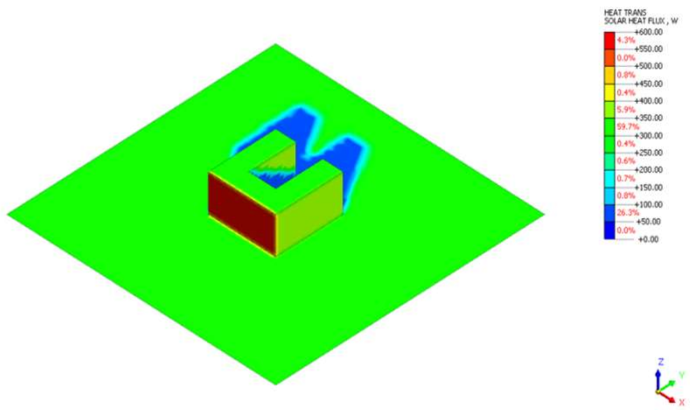
Users can set geographic coordinates, mesh direction, date, time, and other related parameters in solar properties. Depending on the solar method, options such as the theoretical maximum (ignoring the atmospheric effect), application of the atmospheric composition (seasonal weather effect), and the solar coefficient can be set.

A spectral ratio represents the ratio of infrared rays among visible rays (short wave) and infrared rays (infrared rays; long wave) excluding ultraviolet rays, and 0.5 indicates that 50% of visible rays and infrared rays exist. The scattering ratio refers to the amount of unabsorbed radiant heat dissipated toward all the ground. The default value of the scattering ratio is 1. Users can set the ground reflectivity in midas NFX to define how much ground reflects the sunlight. The general ground has 0.2 for reflectivity ratio, and 0.7 can be used for the surface where snow is piled up, and so on.

In addition, users can set the transparency for the target model based on the previously defined sunlight. By selecting the opacity (absorption rate) and transparency (absorption rate, transmittance), sunlight is transmitted; that is, it is possible to analyze the physical properties of the shared object.



〈Solar heat definition interface〉

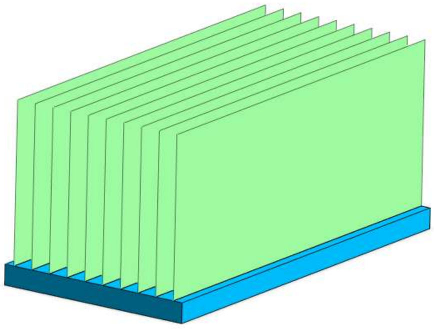


〈 On December 25th at 10:30am Seoul,
Solar heat flux result under conditions reflecting weather effect 〉

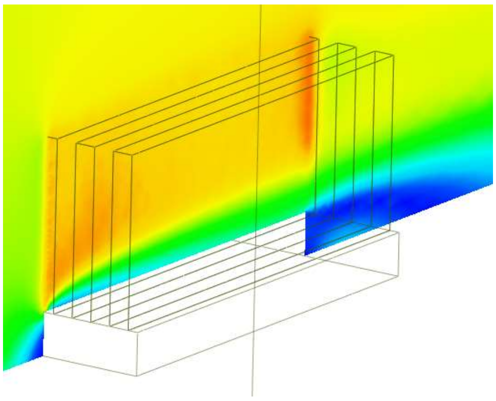
Thin Plate Model (CFD)

〈 Purpose of development and method of use 〉

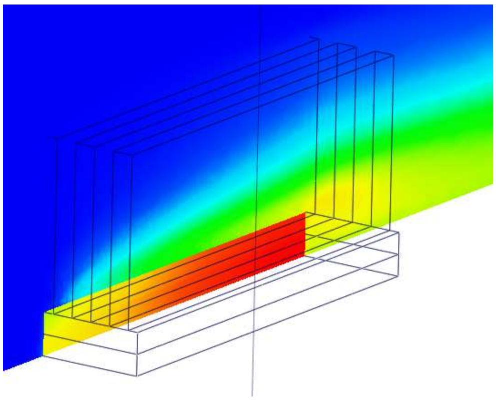
Many engineering issues are related to heating value. Heat must be removed to protect parts vulnerable to high temperatures, and it usually is discarded in fluids such as air. A heat sink is a device that quickly transfers heat generated from a heat source to a fluid. Several thin cooling fins increase the heat dissipation effect by increasing the contact surface with the fluid as much as possible. However, putting many elements in a thin and dense structure consumes too much computing resources. The thin plate model is applied to the cooling fins of a heat sink by simplifying the cooling fin to a surface without volume, which decreases the computing time. Also, it accurately calculates the fluid-solid heat transfer by reflecting the boundary layer effect that occurs in the flow over the solid wall.



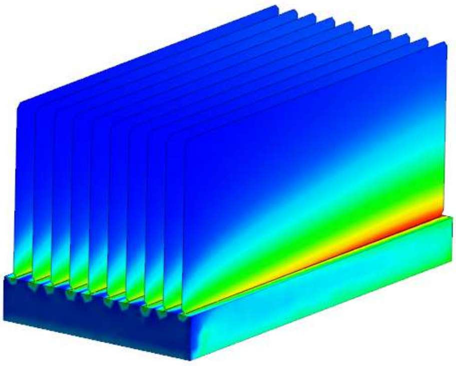
〈Heat sink model〉



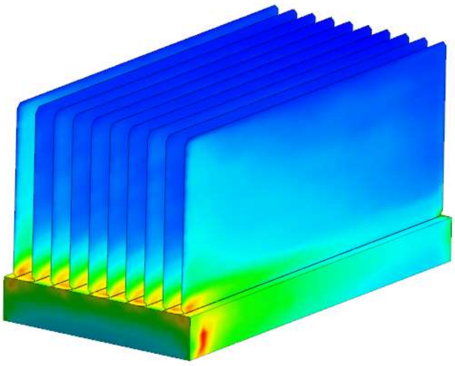
〈The flow velocity distribution between cooling fins〉



〈 The temperature distribution between cooling fins 〉



〈The temperature distribution of heat sink surface〉



〈The convective heat transfer coefficient distribution〉

Other Enhancements

< Authentication method related to abnormal termination >

In web authentication, the license accesses are overlapped if the program is not normally terminated due to a network error or incomplete termination. By changing the authentication method, this error does not occur. The improved authentication method is the Heartbeat method, which checks whether the connection between the product and the server is stable by transmitting and receiving signals every few minutes. If the connection is not maintained, the product access status on the server-side is forcibly released with a brief delay.

< Node average stress calculation>

The method of averaging the element stress components (stress by direction, principal stress) is improved by averaging the element stress by direction and then calculating the principal stress again. In the previous method, a slight difference occurred between the von-Mises stress calculated based on the stress component for each direction and the von-Mises stress calculated using the principal stress component. However, the same von- Mises stress can be obtained by introducing the new method.

< The position of result value at the maximum/minimum display function>

In the previous version, the stress result value was displayed at the element's center when using the maximum/minimum display function in the node average state. By fixing this problem, the maximum/minimum result value is displayed on the node at the node average state and on the center of the element at the element-centered state.

< The unit system for the display of legend at random response analysis>

When checking the random response analysis results, the unit system has been improved to be displayed according to the PSD and NPX items in the legend.