Multidisciplinary analysis solution for optimum design

midas NFX **2018R1** **Release Note**

midas NFX
RELEASE NOTE

2018 R1

Major Improvements

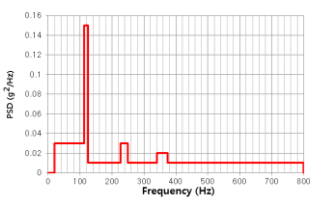
Midas NFX is an integrated finite element analysis program for structural, CFD simulation and optimization design. It provides efficient and accurate analysis together with an integrated pre-post processor, developed by senior mechanical engineers with over 20 years of CAE software development expertise.

The 2018 version of midas NFX contains several improvements for easier and faster meshing, it includes improvements for fatigue analysis, CFD boundary condition definition and post-processing tools.

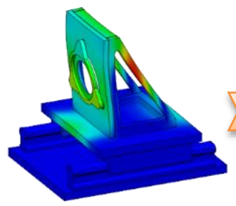
Random Vibration Fatigue analysis

〈Purpose〉

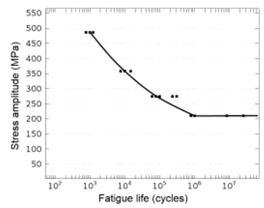
Random vibration analysis is widely used to analyze the response of a structure to random vibrations transmitted through vehicles such as automobiles and railways and airplanes. When the random vibration is continuously generated, the fatigue life evaluation is required accordingly.



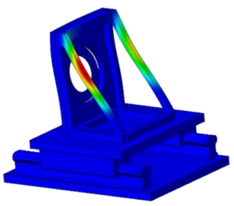
①Input : PSD function



②Random vibration Analysis



③Fatigue material property (S-N Curve)



④Fatigue Analysis

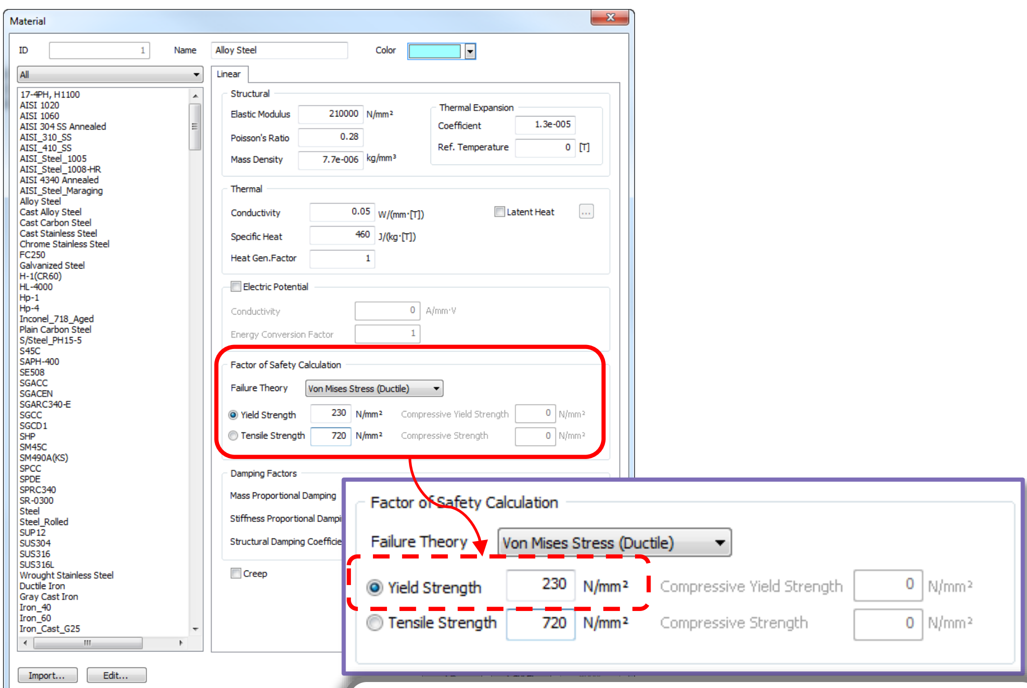
Random Vibration Fatigue analysis workflow

〈Workflow process〉

In the random vibration fatigue analysis, tensile input and frequency density function moment must be selected according to the procedure of Step 1 and 2 before the random vibration analysis.
After the random vibration analysis, you can follow the steps below for each analysis case.

Step 1

Tensile Strength input

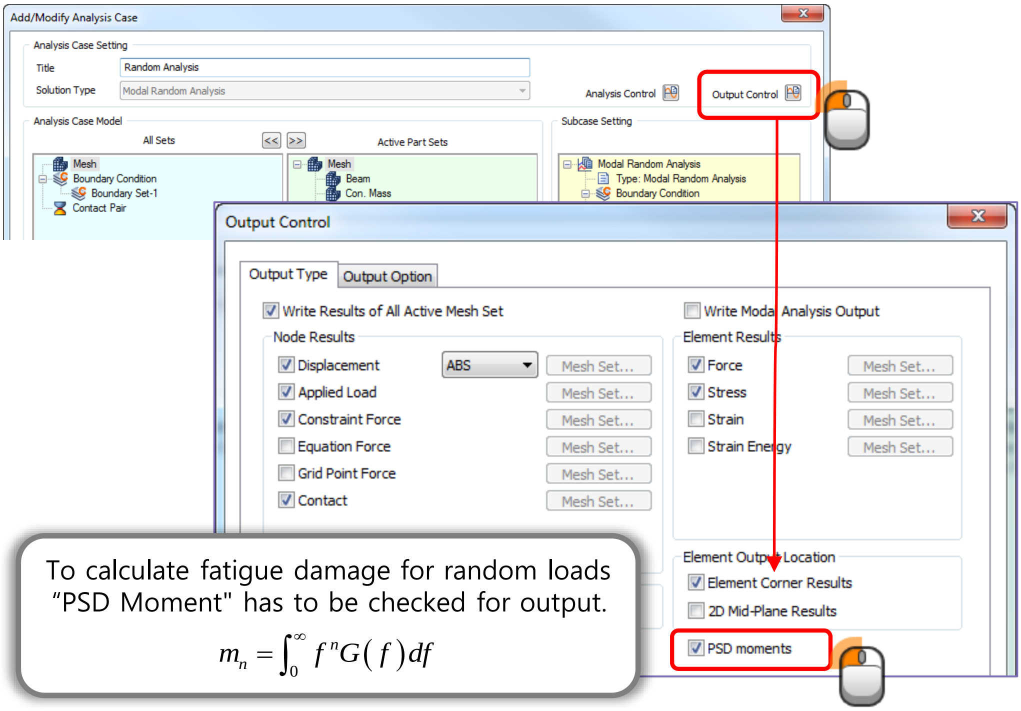


Enter the value corresponding to the allowable stress for the material used for fatigue analysis in the "Tensile" field.

Random Vibration Fatigue analysis

Step 2

Go to Output Control

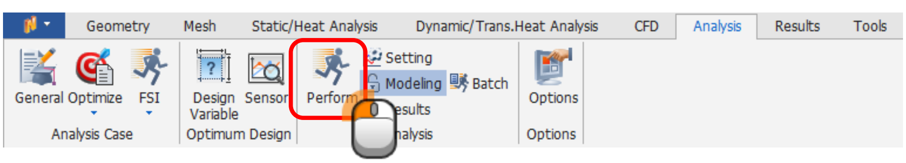


To calculate fatigue damage for random loads "PSD Moment" has to be checked for output.

$$m_n = \int_0^\infty f^n G(f)\,df$$

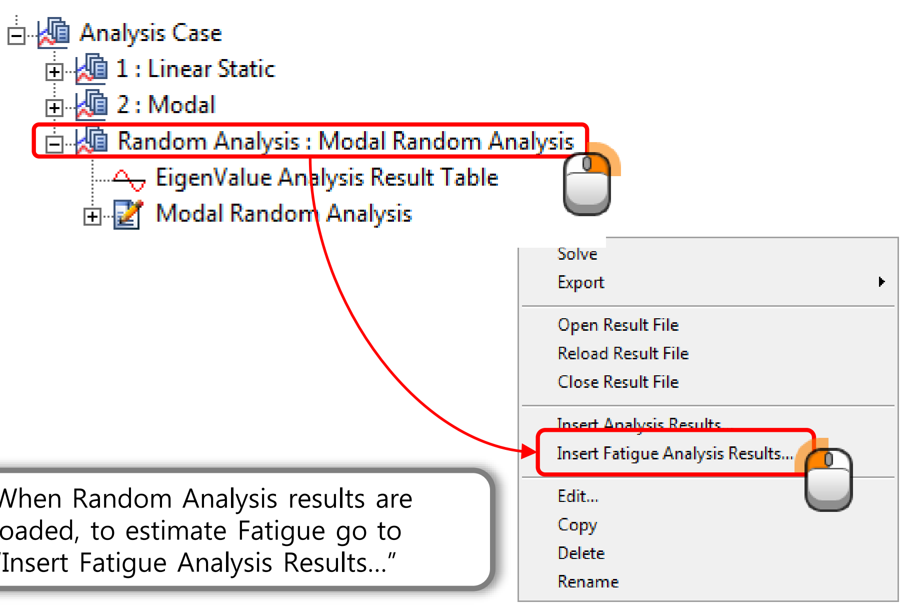
Step 3

Analysis Run



Step 4

Go to Fatigue Module

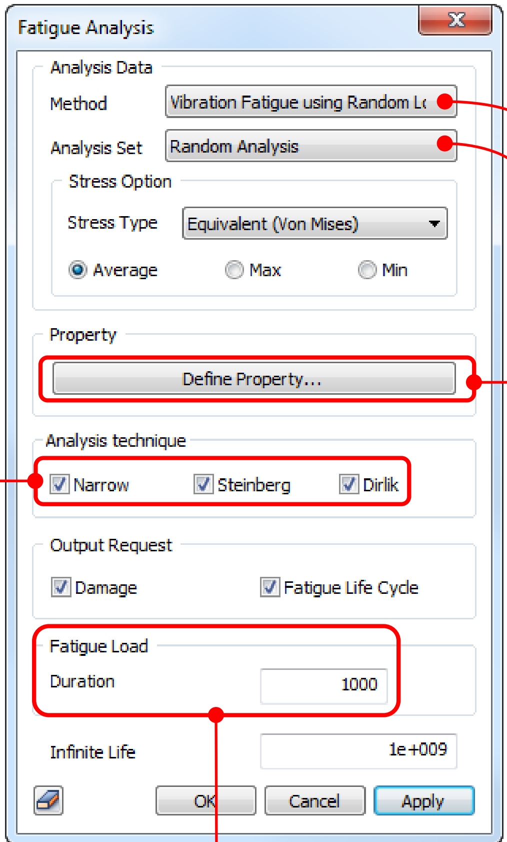


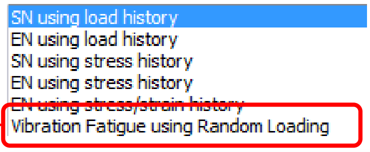
When Random Analysis results are loaded, to estimate Fatigue go to "Insert Fatigue Analysis Results..."

Random Vibration Fatigue analysis

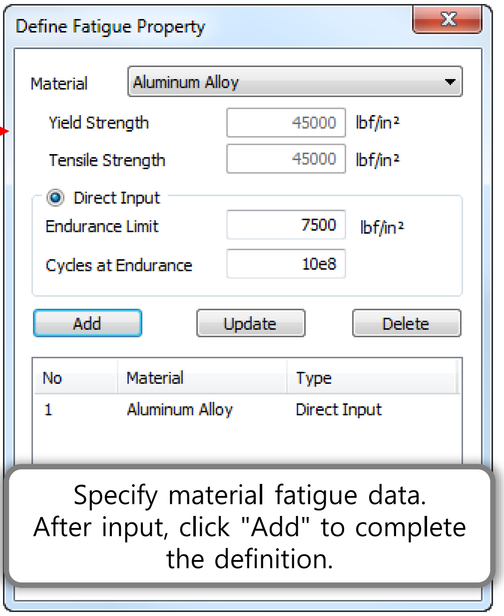
Step 5

Fatigue Analysis





Random type Analysis Set selection



Specify material fatigue data.
After input, click "Add" to complete the definition.

T – exposure time duration
(it follows the time unit defined by user)

Ex : The beam is exposed to random vibration load for 16-17 minutes. Selected unit [sec]; Input: 1000 [sec]

Frequency domain analysis methods:

1)Narrow Band
: Assumes that the stress ranges are distributed as the Rayleigh distributed peaks of the limiting narrowband process.

2)Steinberg
: Assumes that PSD function follows Gaussian distribution and no stress cycles occur with ranges greater than 6 sigma RMS.
Used commonly in electronic industry.

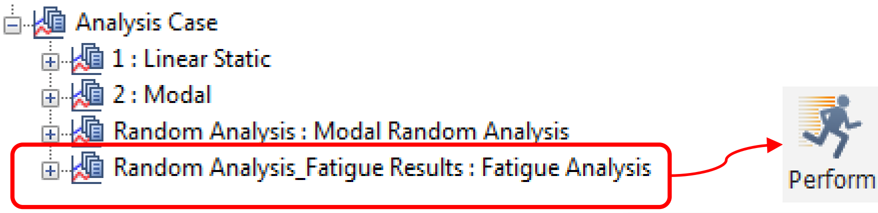
3)Dirlik
: Method uses empirical closed-form expression for Probability Density Function of stress amplitude, based on the Monte Carlo technology. General purpose.

[Tip]
Use all methods and select most conservative result.

Random Vibration Fatigue analysis

Step 6

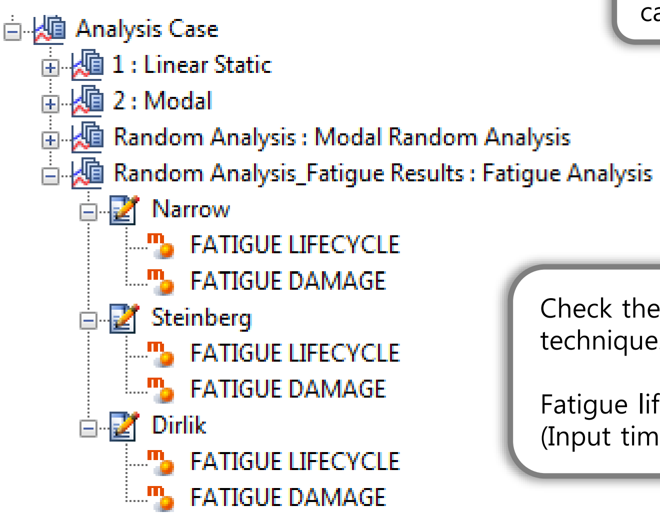
Run Fatigue Analysis



Run the newly created 'Fatigue Analysis' analysis case.

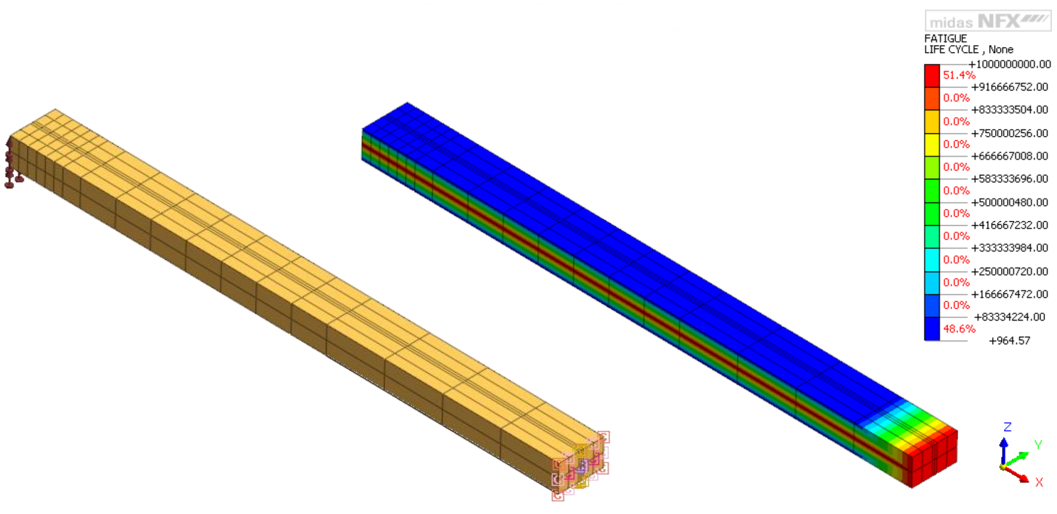
Step 7

Display Fatigue Results



Check the results for each analysis technique.

Fatigue life is a concept of time. (Input time unit)

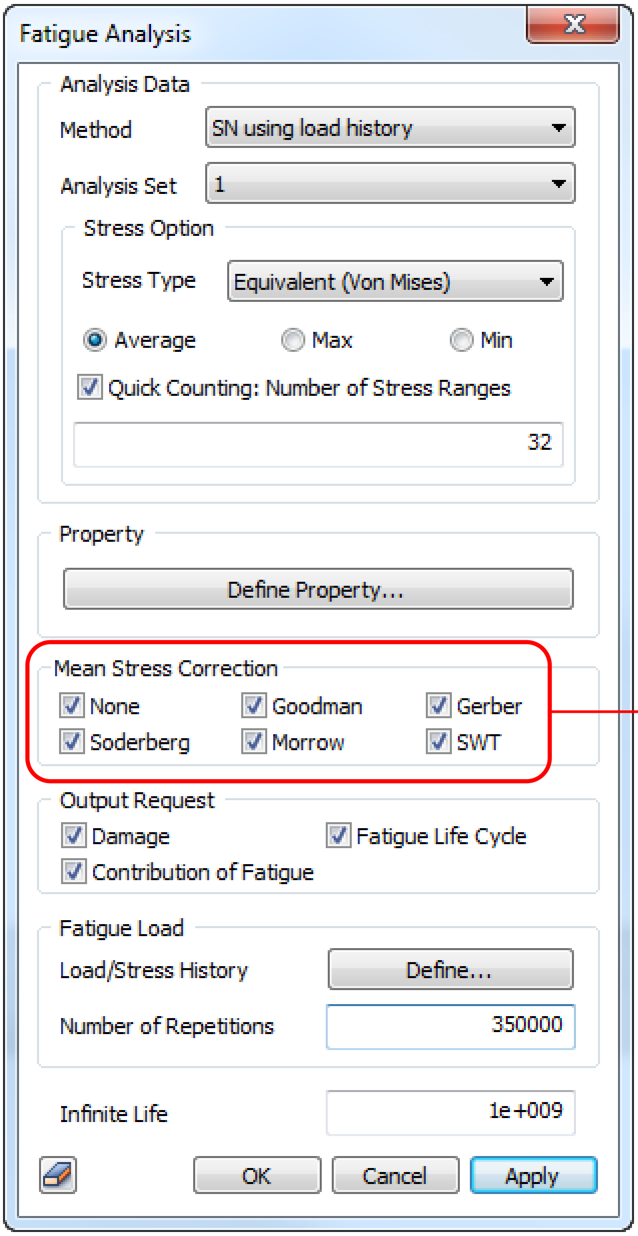


[DATA] Random Analysis_Fatigue Results, Narrow, [UNIT] lbf, in

Fatigue Analysis

<Purpose>

'Soderberg', 'Morrow', and 'SWT' have been developed according to customer's requests for more various methods in the existing developed mean stress correction techniques. You can also use the 'Fatigue Contribution' function in the output to analyze fatigue analysis results.



None

Goodman $\dfrac{\sigma_a}{\sigma'_e} + \dfrac{\sigma_m}{\sigma_u} = 1$

Gerber $\dfrac{\sigma_a}{\sigma'_e} + \left(\dfrac{\sigma_m}{\sigma_u}\right)^2 = 1$

Soderberg $\dfrac{\sigma_a}{\sigma'_e} + \dfrac{\sigma_m}{\sigma_y} = 1$

Morrow $\dfrac{\sigma_a}{\sigma'_e} + \dfrac{\sigma_m}{\sigma_f} = 1$

SWT $S_{ar} = \sqrt{S_a S_{max}}$

σ_a : Stress Amplitude

σ_m : Mean Stress

σ_y : Yield Stress

σ_u : Ultimate Stress

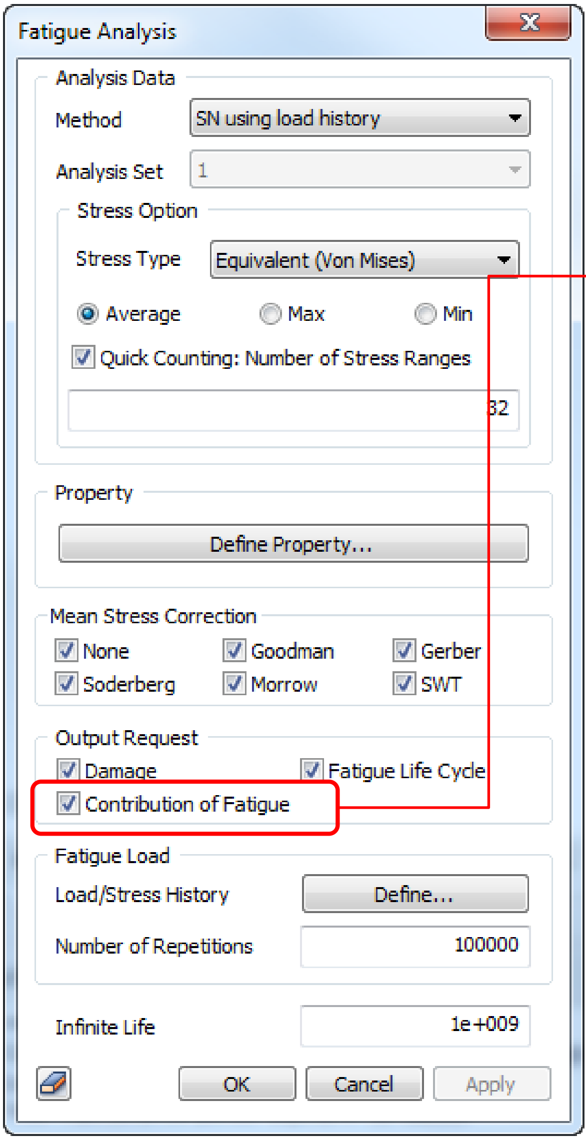
σ_f : True Fracture Stress

σ'_e : Effective Alternating Stress

S_u : Ultimate Strength Stress (NFX: Tensile Strength)

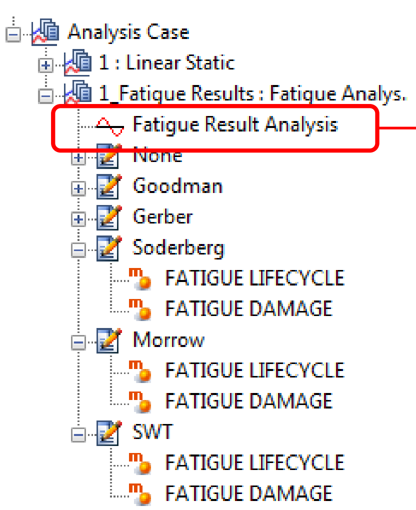
S_e : Endurance Limit Stress

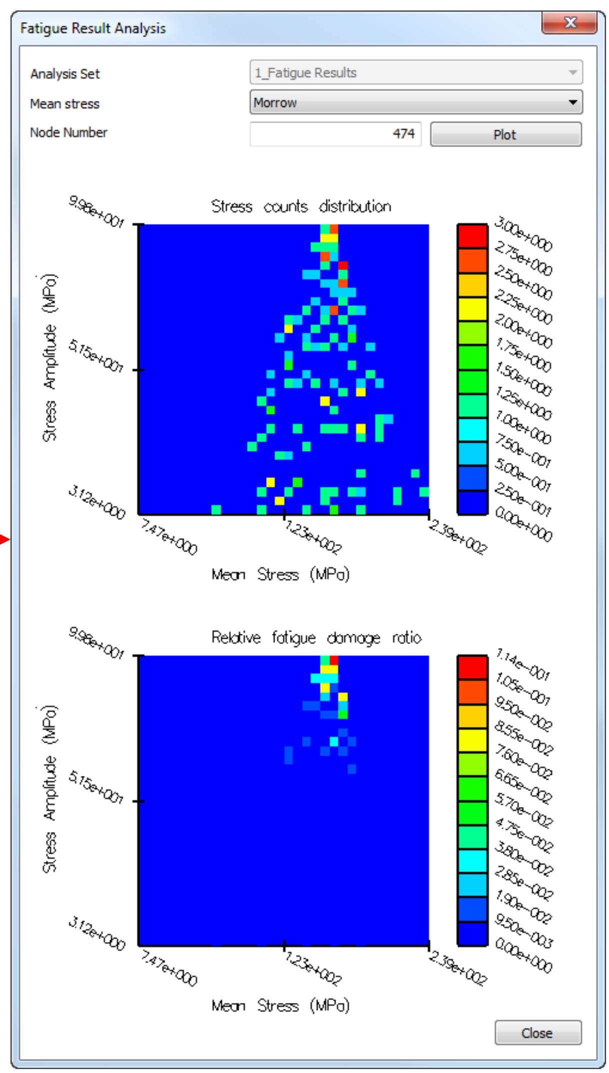
Fatigue Analysis



1) The relationship between the average stress and the stress amplitude in the fatigue analysis results

2) When checking fatigue contribution the "Quick Counting" is enabled automatically with the default value of 32 and outputs the result.

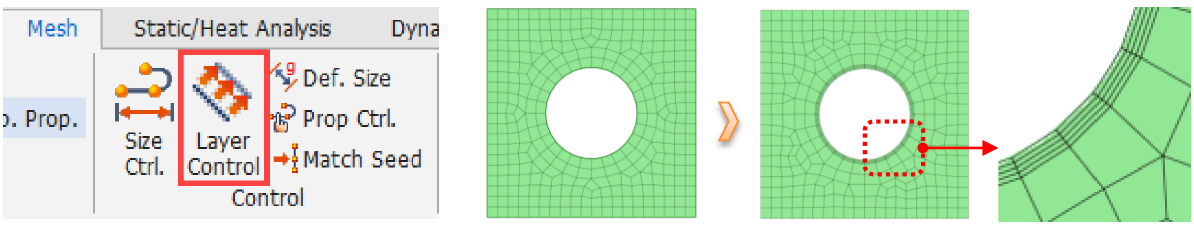




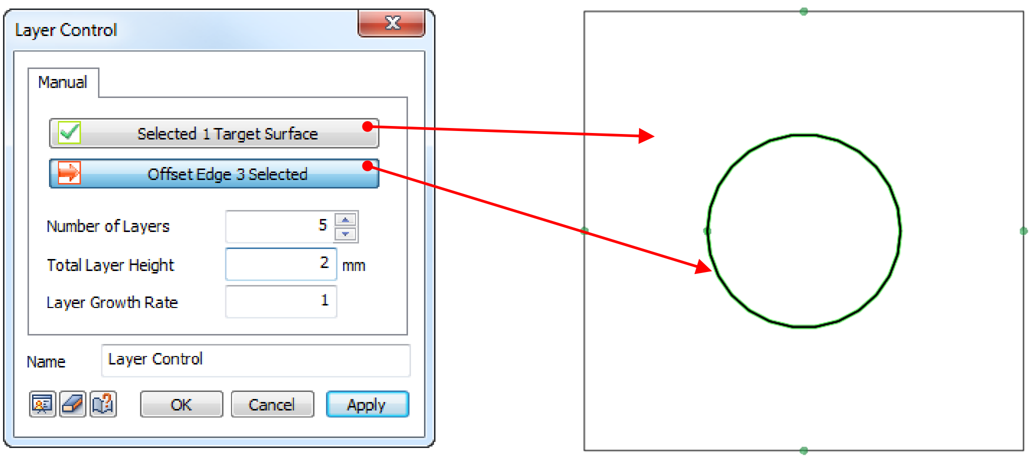
Layer Control tool

< Purpose and usage >

New mesh seed control method has been added. This tool creates several layers of mesh around holes for more accurate grasp of stress concentration.



Mesh without LC tool   Mesh with LC element offset

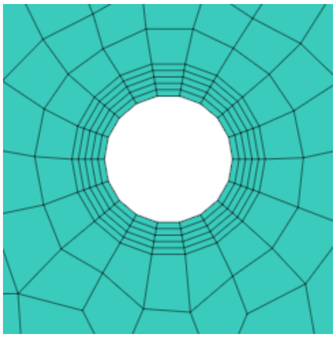


1) Number of boundary layers: Specify the number of layers to be offset (minimum value 1)

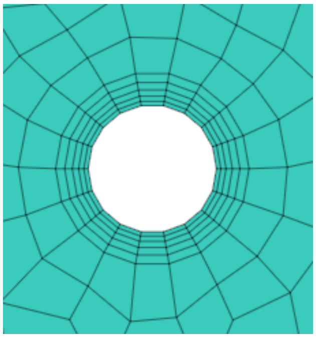
2) Total Boundary Layer Height: Specifies the height of the total number of boundary layers.

3) Boundary layer growth ratio: proportionally adjusts the height value as the layer advances when the number of boundary layers is 2 or more

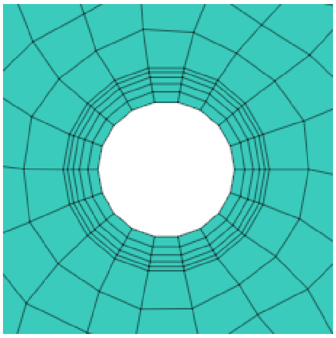
Ex) When 1 is input, it is represented by the same height. If it is larger than 1, it becomes larger. If it is smaller than 1 a layer is created with increasingly smaller heights.



Layer Growth Rate 1



Layer Growth Rate 1.2

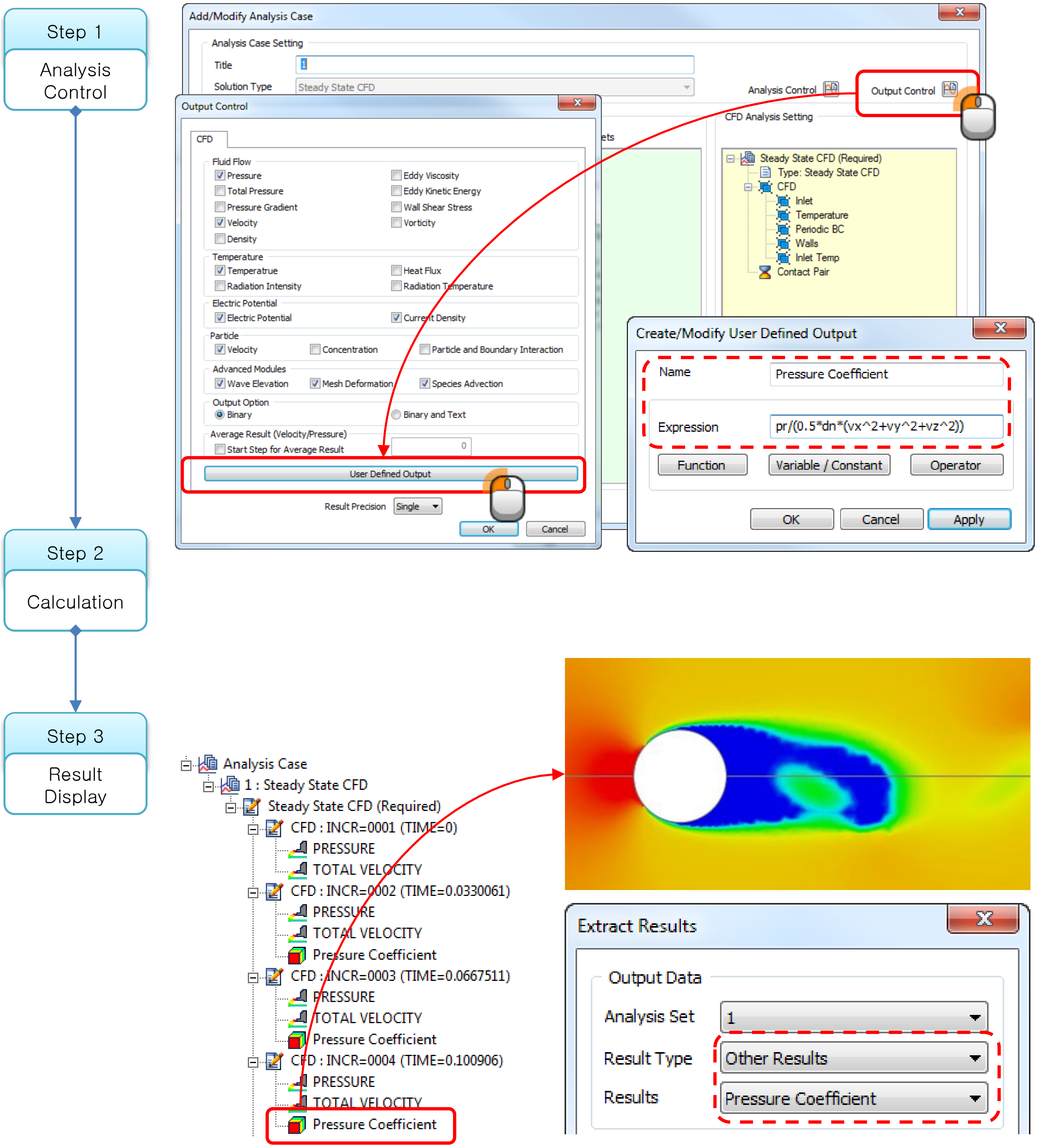


Layer Growth Rate 0.8

CFD: User Defined Function

< Purpose >

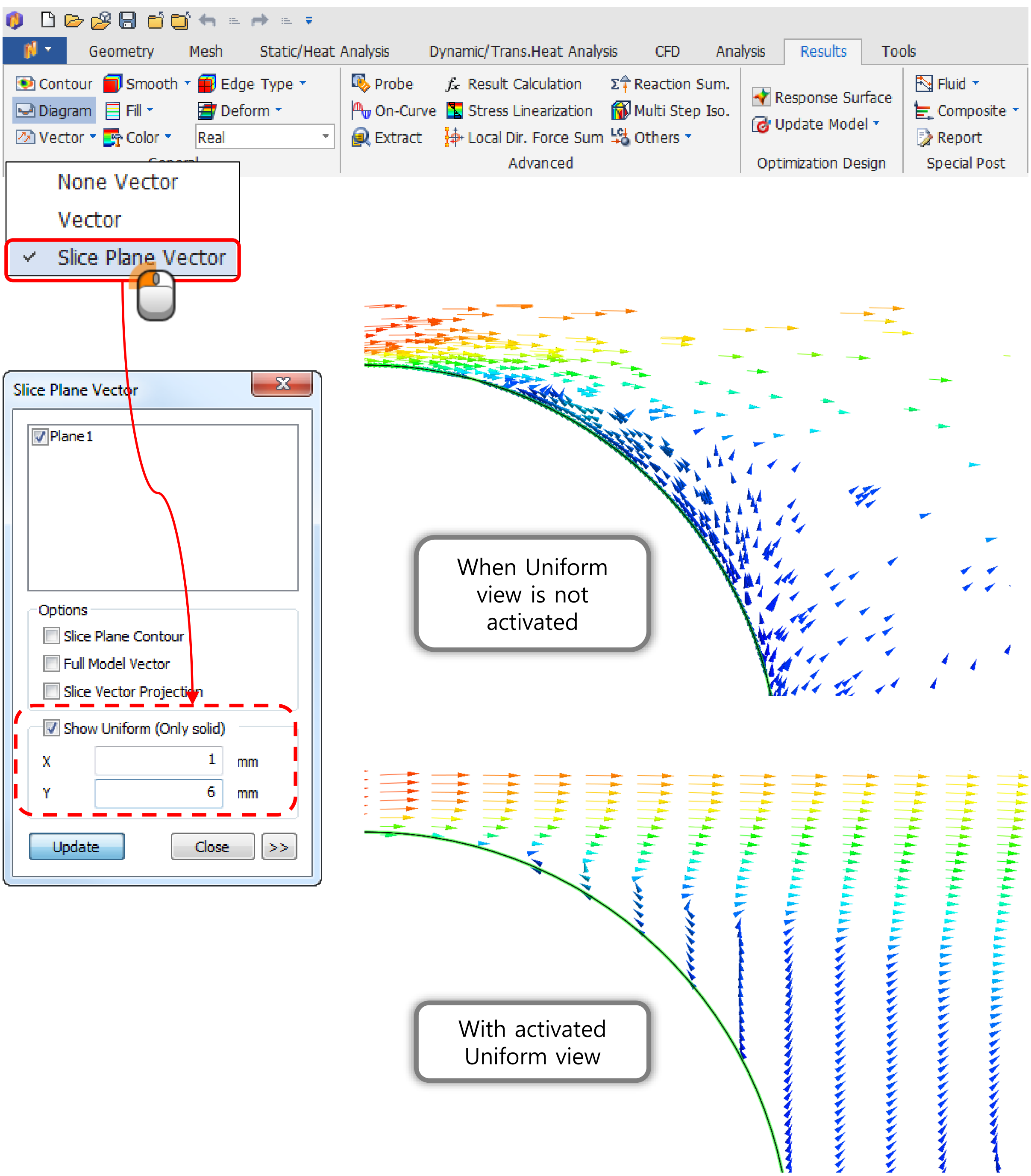
When the flow analysis is performed, the results are output only for the pressure, speed, temperature, etc. calculated basically. User-defined functions have been added to allow users to set up additional functions to output results or contours.



CFD: Uniform Slice Vector

< Purpose >

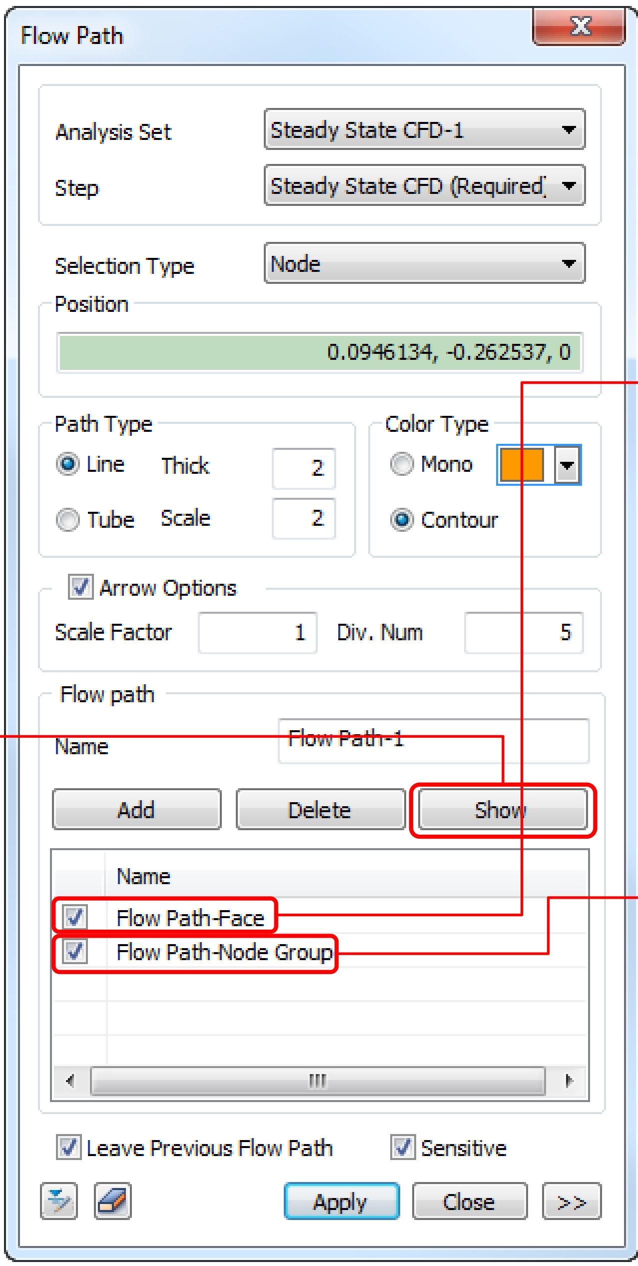
With the existing vector feature, vectors are displayed according to mesh density. Using the homogenization function of the intersection plane, it draws a uniformly arranged vector independent of the density of the mesh. You can also set the X-direction spacing and the Y-direction spacing differently.

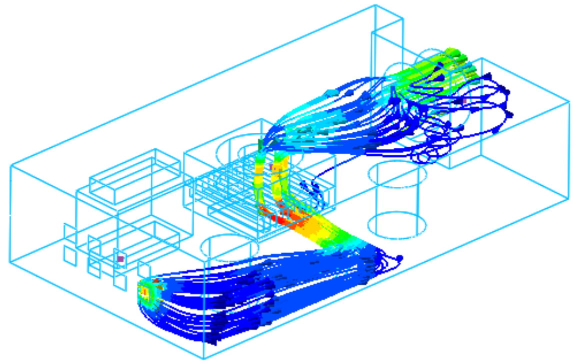


CFD: Streamline saving option

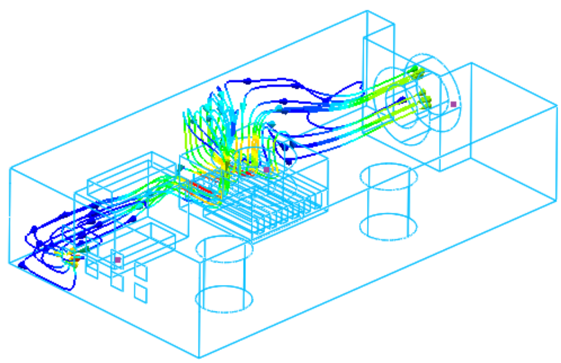
< Purpose>

Due to previous inconvenience with streamlines displaying, now it is possible to create groups of flow patch and save their position for future use.

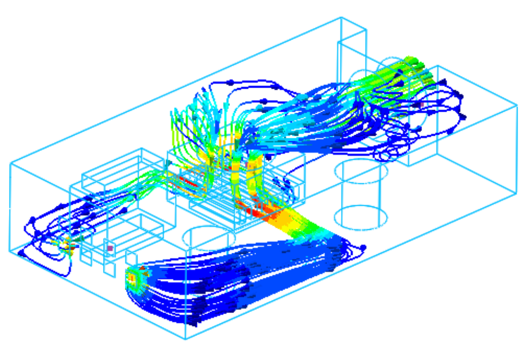




Streamlines from selected Face



Streamlines from selected nodes



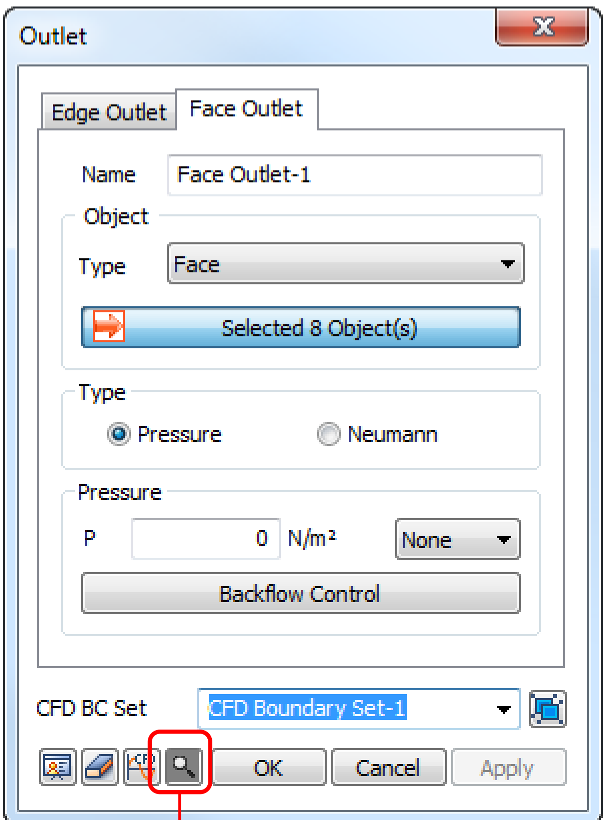
Show button activates displaying of selected/created flow path sets

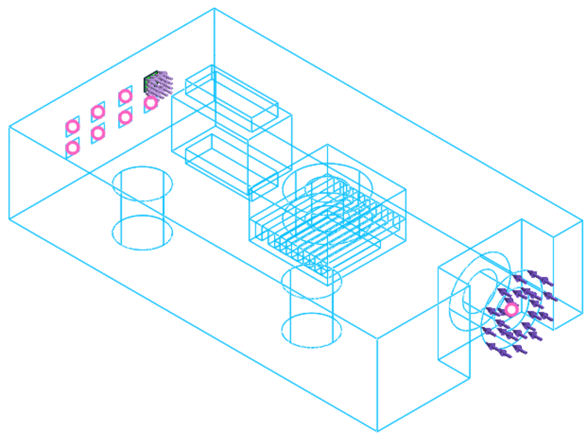
Streamlines from 2 separate sets

CFD: "Show unassociated boundaries"

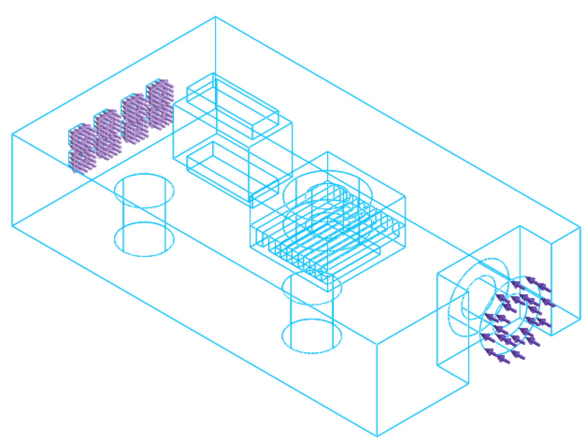
< Purpose>

In the flow analysis, all boundaries of the analysis area must be given boundary conditions. However, if the model is complicated, it is easy to make mistakes that miss the boundary condition input. NFX 2018R1 provides **unspecified boundary detection,** so that you can find faces of the boundary that are free from boundary conditions. This function can be used when using inlet, outlet, and wall conditions frequently used in flow analysis.





New tool indicates all unassociated faces



Fully defined outlet BC

Click the magnifying glass icon on the inlet, outlet, and wall conditions to see the location of the boundary that has not yet been bounded.

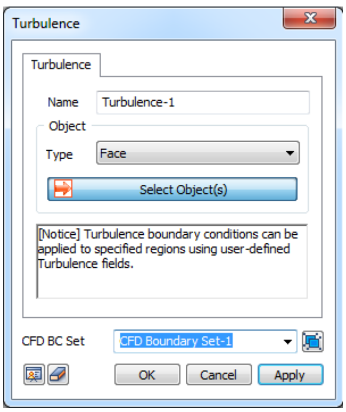
CFD: BC application

< Purpose>

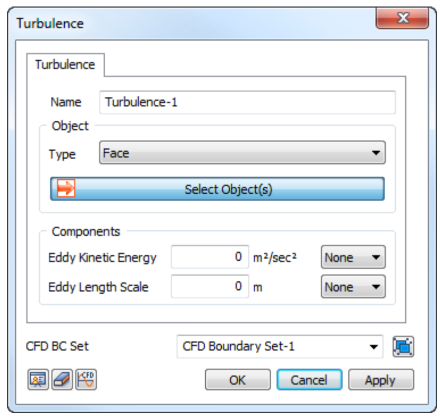
To improve application of the boundary conditions, which were previously dependent to initial condition setting.

[Turbulence]

The existing method of defining the turbulence characteristics was inconvenient to distinguish the initial condition from the boundary condition because the value was entered in the field definition. The NFX 2018R1 can independently impart turbulence characteristics (turbulent kinetic energy, turbulence length measure) at boundary conditions. It is also possible to apply the function to the turbulent characteristic boundary condition.



< midas NFX 2017R1 input >

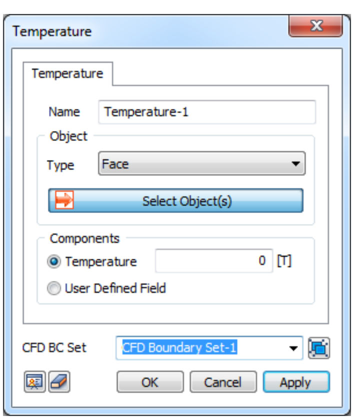


<midas NFX 2018R1 input>

[Fixed temperature]

Existing NFXs had to use User Defined Field definitions to set a fixed temperature function as the boundary condition. The function was complicated or limited in practical usage.

The NFX 2018R1 improves user convenience by allowing separate functions to apply fixed temperature boundary conditions.



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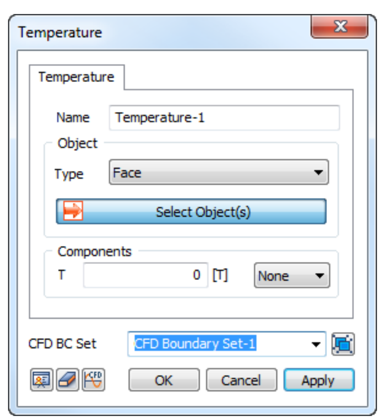

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