



Multidisciplinary analysis solution for optimum design

# midas NFX 2019R1 Release Notes



# midas NFX

Introducing Improvements

# 2019 R1

## Major Improvements

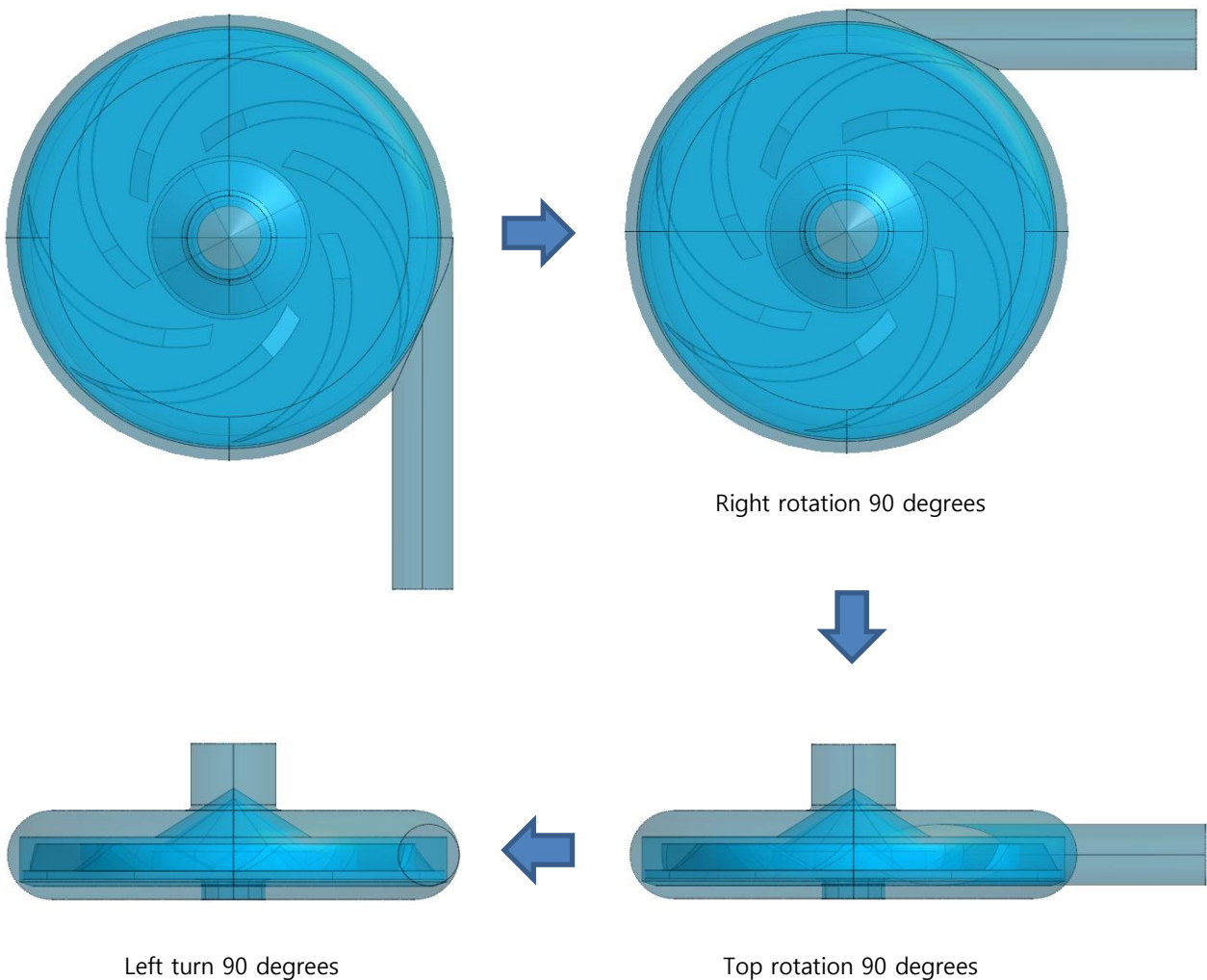
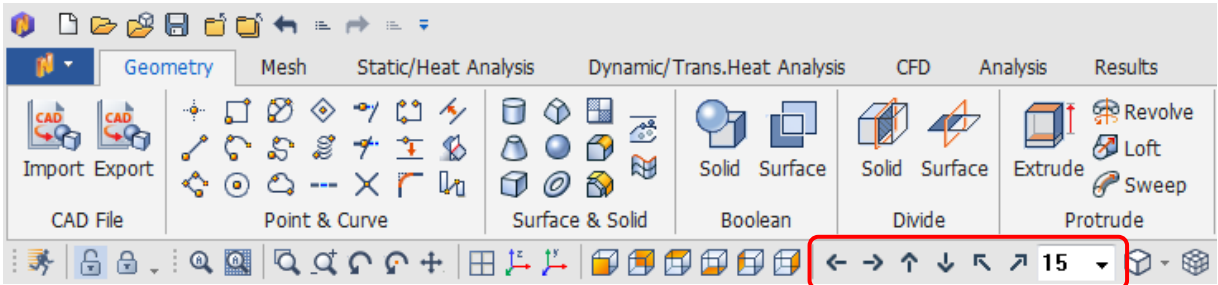
Midas NFX is an integrated finite element analysis program for structural, CFD simulation and optimization design. It provides efficient and accurate analysis together with an integrated pre-post processor, developed by senior mechanical engineers with over 20 years of CAE software development expertise.

The 2019 version of midas NFX contains several improvements for topological optimization, contact feature, CFD boundary condition definition and post-processing tools.

# New View Controls

## < Development Purpose and Usage Method >

In everyday practice there is a need to display the graphical result of a certain angle or rotate the model. In such case, you can use the newly added specific angle rotation function. Type or select the angle you want to rotate and click the icon in the direction you want to rotate.



# Result Extract new option

## < Development Purpose and Usage Method >

New option has been added [Object] to output the results from nodes or elements. Up to the previous version, you have to select the desired joint for each increment by using the "Result Tag" function to output the average value of the stresses of the joints.

**1** Output Data section: Analysis Set (Nonlinear Static-1), Result Type (Solid Stresses), Results (SOLID STRS VON MISES).

**2** Order section:  Step,  Node/Element.

**3** Object section:  Node,  Element.

**4** Nodal Results Extraction section:  User Defined, Select Object (2), Sort (X, Y, Z, Ascending),  Maximum,  Minimum,  Abs. Max,  Only Show Node/Element, Extraction Position in Element.

No	Step	Step Value	Node: 2 (N/mm <sup>2</sup> )
1	Nonlinear Static (Required):INCR=0 (LOAD=0.000)	0.000000e+000	0.000000e+000
2	Nonlinear Static (Required):INCR=1 (LOAD=0.050)	5.000000e-002	5.347632e+002
3	Nonlinear Static (Required):INCR=2 (LOAD=0.100)	1.000000e-001	1.070558e+003
4	Nonlinear Static (Required):INCR=3 (LOAD=0.150)	1.500000e-001	1.607387e+003
5	Nonlinear Static (Required):INCR=4 (LOAD=0.200)	2.000000e-001	2.145254e+003
6	Nonlinear Static (Required):INCR=5 (LOAD=0.250)	2.500000e-001	2.684160e+003
7	Nonlinear Static (Required):INCR=6 (LOAD=0.300)	3.000000e-001	3.224108e+003
8	Nonlinear Static (Required):INCR=7 (LOAD=0.350)	3.500000e-001	3.765158e+003
9	Nonlinear Static (Required):INCR=8 (LOAD=0.400)	4.000000e-001	4.307225e+003
10	Nonlinear Static (Required):INCR=9 (LOAD=0.450)	4.500000e-001	4.850335e+003
11	Nonlinear Static (Required):INCR=10 (LOAD=0.500)	5.000000e-001	5.394506e+003
12	Nonlinear Static (Required):INCR=11 (LOAD=0.550)	5.500000e-001	5.939732e+003
13	Nonlinear Static (Required):INCR=12 (LOAD=0.600)	6.000000e-001	6.486022e+003
14	Nonlinear Static (Required):INCR=13 (LOAD=0.650)	6.500000e-001	7.033378e+003
15	Nonlinear Static (Required):INCR=14 (LOAD=0.700)	7.000000e-001	7.581797e+003
16	Nonlinear Static (Required):INCR=15 (LOAD=0.750)	7.500000e-001	8.131284e+003
17	Nonlinear Static (Required):INCR=16 (LOAD=0.800)	8.000000e-001	8.681848e+003
18	Nonlinear Static (Required):INCR=17 (LOAD=0.850)	8.500000e-001	9.233481e+003
19	Nonlinear Static (Required):INCR=18 (LOAD=0.900)	9.000000e-001	9.786189e+003
20	Nonlinear Static (Required):INCR=19 (LOAD=0.950)	9.500000e-001	1.033998e+004
21	Nonlinear Static (Required):INCR=20 (LOAD=1.000)	1.000000e+000	1.089482e+004

Object:  Node,  Element

No	Step	Step Value	Elem: 2 Center...
1	Nonlinear Static (Required):INCR=0 (LOAD=0.000)	0.000000e+000	0.000000e+000
2	Nonlinear Static (Required):INCR=1 (LOAD=0.050)	5.000000e-002	5.396041e+002
3	Nonlinear Static (Required):INCR=2 (LOAD=0.100)	1.000000e-001	1.080334e+003
4	Nonlinear Static (Required):INCR=3 (LOAD=0.150)	1.500000e-001	1.622194e+003
5	Nonlinear Static (Required):INCR=4 (LOAD=0.200)	2.000000e-001	2.165188e+003
6	Nonlinear Static (Required):INCR=5 (LOAD=0.250)	2.500000e-001	2.709321e+003
7	Nonlinear Static (Required):INCR=6 (LOAD=0.300)	3.000000e-001	3.254597e+003
8	Nonlinear Static (Required):INCR=7 (LOAD=0.350)	3.500000e-001	3.801090e+003
9	Nonlinear Static (Required):INCR=8 (LOAD=0.400)	4.000000e-001	4.348696e+003
10	Nonlinear Static (Required):INCR=9 (LOAD=0.450)	4.500000e-001	4.897451e+003

Entity Type:  Node,  Element

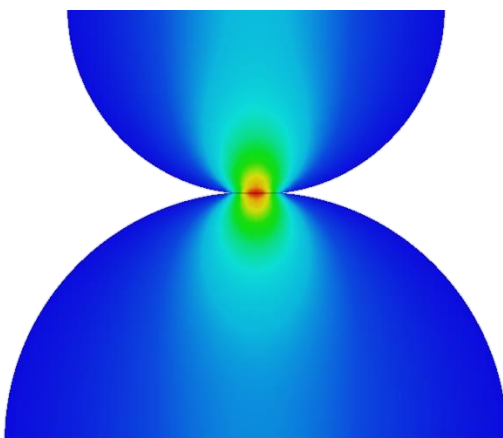
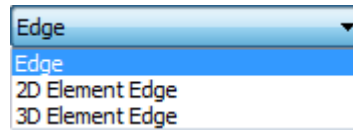
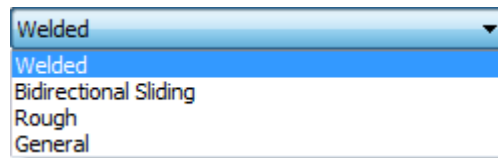
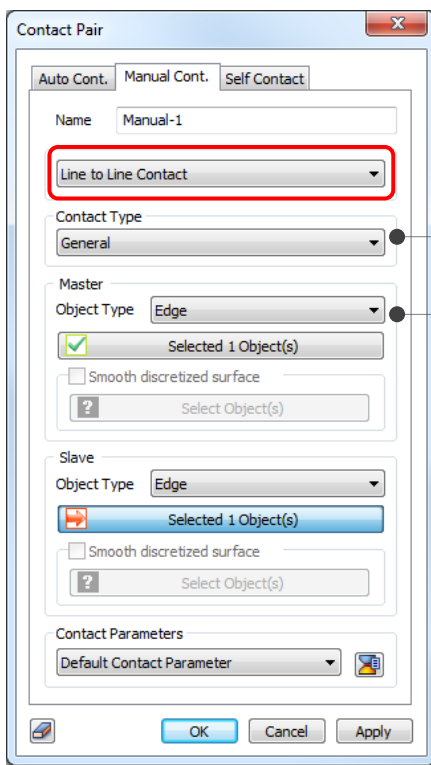
Show	Type	ID	Value
<input checked="" type="checkbox"/>	Node	2	10339.9834
<input checked="" type="checkbox"/>	Elem	2	10449.7959

\*Previously this feature was accessible via Probe tool only.

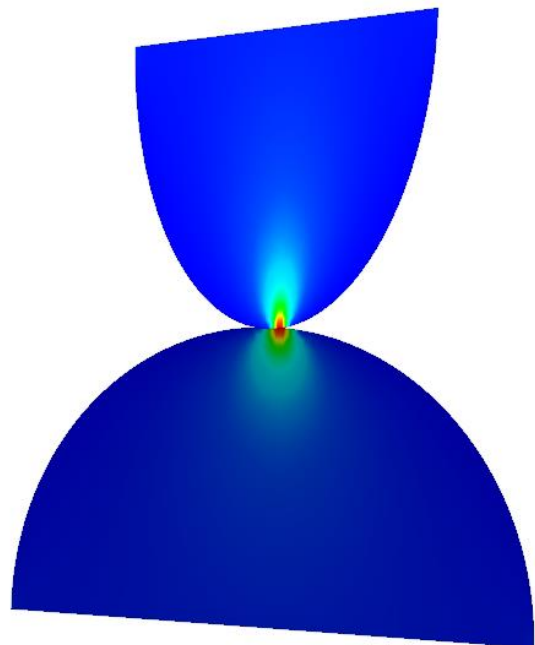
# Line to Line contact

## < Development Purpose and Usage Method >

In addition to existing face-to-face, point-to-face contact, line-to-line contact functionality has been added. It can be used effectively when in-plane direction and out-of-plane direction of a model composed of two-dimensional shell elements occur. Line-to-line contact supports welded and normal contact. Welded contact is available for all analytical types, and general contact functionality is available for nonlinear static analysis, and implicit/explicit nonlinear dynamic analyses. It can be defined using automatic contact and manual contact function of line-to-line contact.



(a) Planar 2D case



(b) 3D Case

2D elements Hertz contact

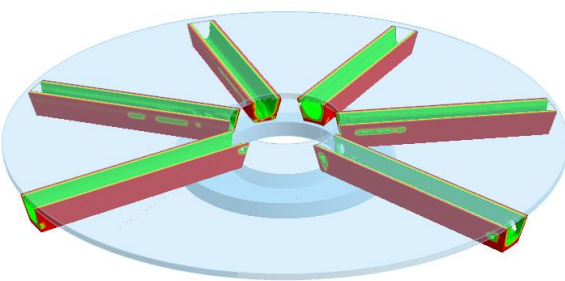
# Manufacturing Conditions Topology Optimization

## < Development Purpose and Usage Method >

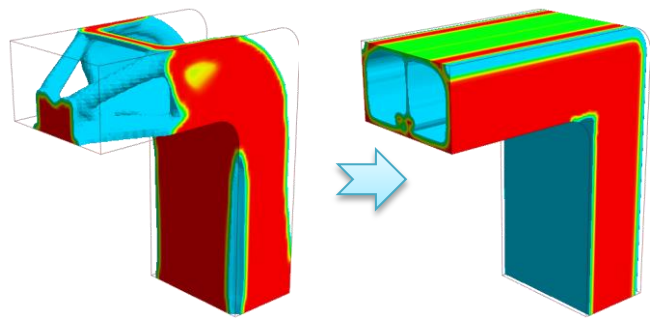
In the phase optimization analysis, the resultant shape can be derived by considering the manufacturing conditions. If you use "molding direction" among the manufacturing conditions, you can use unidirectional, bidirectional, and penetrating, and only the whole rectangular coordinate system can be used as the reference coordinate system. However, if the analytical model is not parallel or horizontally parallel to the orthogonal coordinate system and is tilted to a certain angle, or if the direction to be extracted must be generated along a particular curve, there was a limit to the existing functionality.

In the 2019R1 version, we have developed the manufacturing condition definition method to be able to define a total of six conditions as linear extrusion, curved extrusion, unidirectional casting, bidirectional casting, symmetry and minimum thickness. Compared with existing product version, it is as follows.

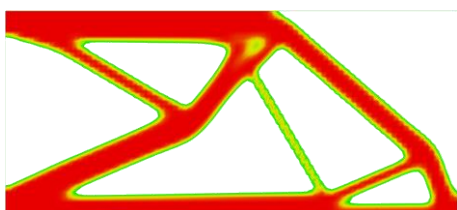
midas NFX 2018R1	midas NFX 2019R1	Remarks
One-way	One-Way	-
Two-way	Two-way	-
Through All	Straight extrusion	-
	Curved extrusion	Can be used when the extruded path is curved.
Repetition	Planar Symmetry	-
-	Minimum Dimension (thickness)	Set the thickness of the generated layout to be greater than or equal to the minimum thickness you enter.



Straight extrusion: User-defined linear direction extraction



Curved extrusion: Extraction of optimized shapes along curved shapes



Result output based on minimum thickness (right: minimum thickness applied)

# Manufacturing Conditions Topology Optimization

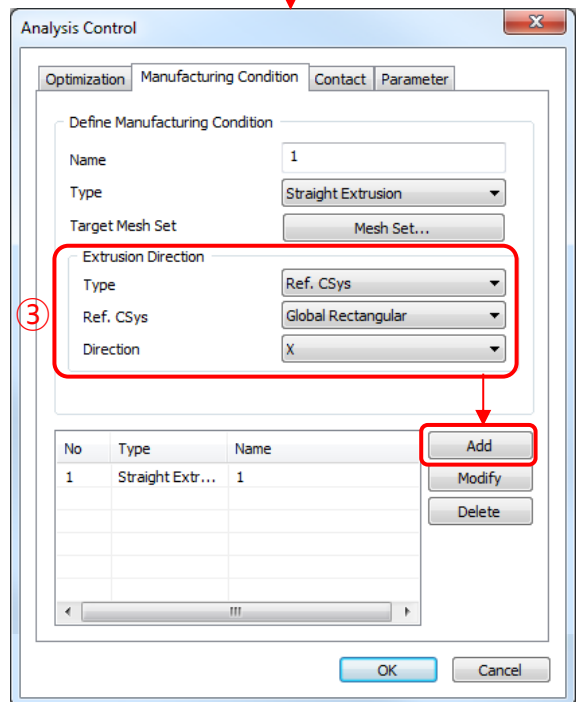
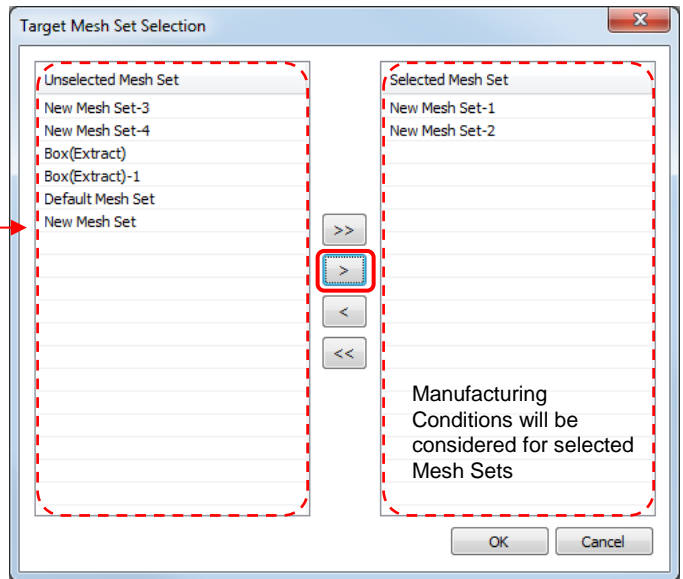
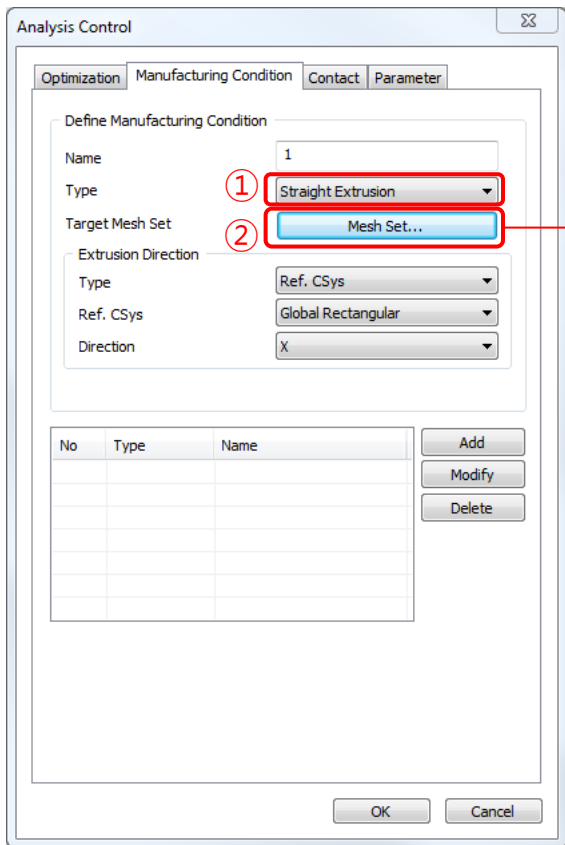
< How to Use >

1) Line extraction, unidirectional casting, bidirectional casting

① Type selection among manufacturing conditions

② Select the mesh set to which the manufacturing condition is applied among the mesh sets selected by the design set

③ Add the definition of manufacturing condition after setting the forming direction



# Manufacturing Conditions Topology Optimization

## < How to Use >

### 1) How to use curve extraction

① Type selection in manufacturing conditions: curve extraction

② Select the mesh set to which the manufacturing condition is applied among the mesh sets selected by the design set

③ Set extrusion path and guide line

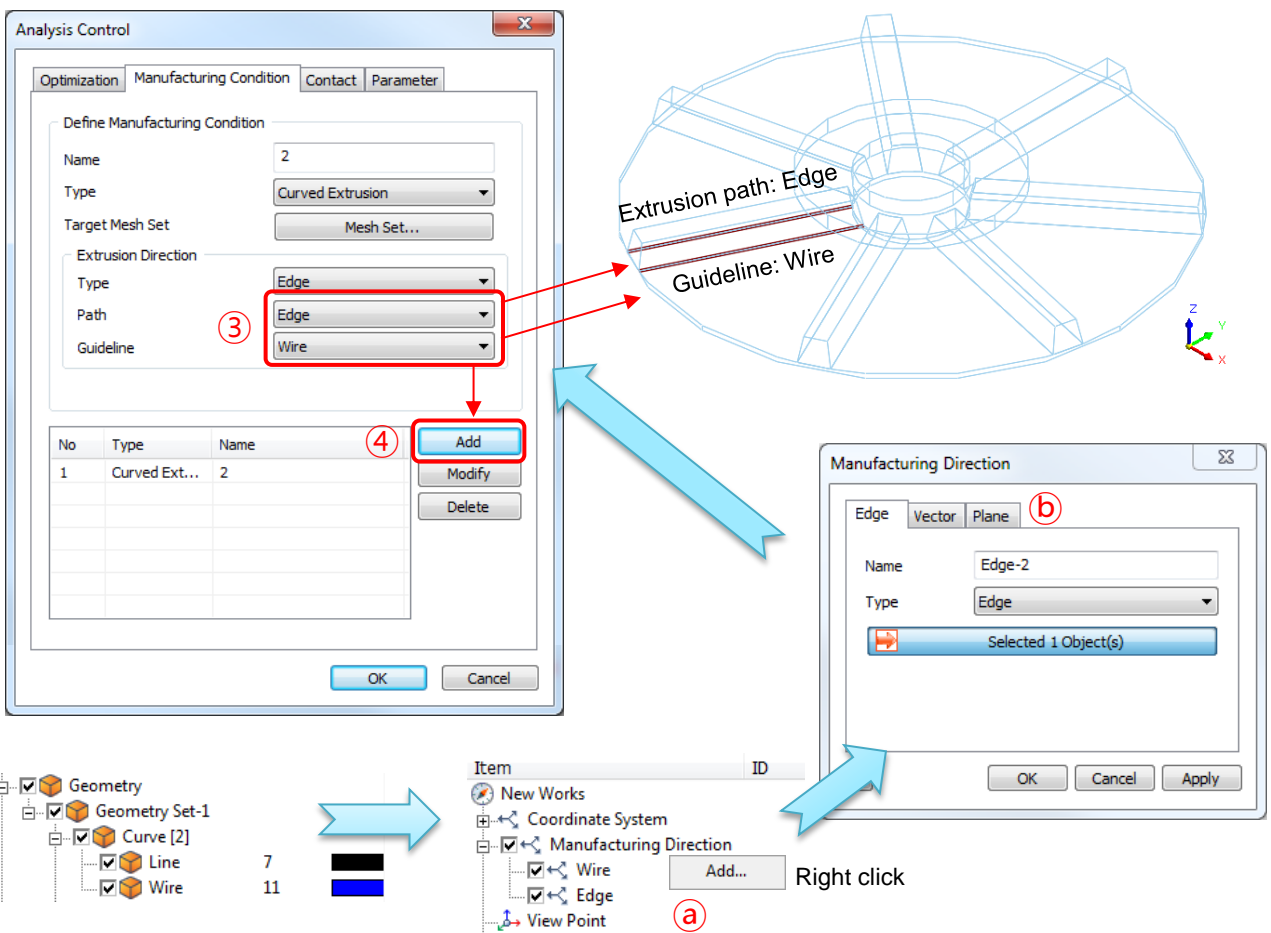
: We can not set the same extrusion path and guidelines using one line

: Extrusion path and guideline generation method

a) Model tree window → Select Manufacturing direction, right-click to select additional

b) Create the geometry or coordinates by selecting the name, type, and line, vector, or face from the desired tab.

④ Addition of definition of manufacturing condition set by addition in analysis



**Analysis Control**

Optimization Manufacturing Condition Contact Parameter

Define Manufacturing Condition

Name: 2

Type: Curved Extrusion

Target Mesh Set: Mesh Set...

Extrusion Direction

Type: Edge

Path: Edge

Guideline: Wire

No	Type	Name
1	Curved Ext...	2

Buttons: Add, Modify, Delete, OK, Cancel

**Manufacturing Direction**

Edge Vector Plane

Name: Edge-2

Type: Edge

Selected 1 Object(s)

Buttons: OK, Cancel, Apply

**Item Tree**

- Geometry
  - Geometry Set-1
    - Curve [2]
    - Line
    - Wire
- New Works
  - Coordinate System
  - Manufacturing Direction
    - Wire
    - Edge
  - View Point

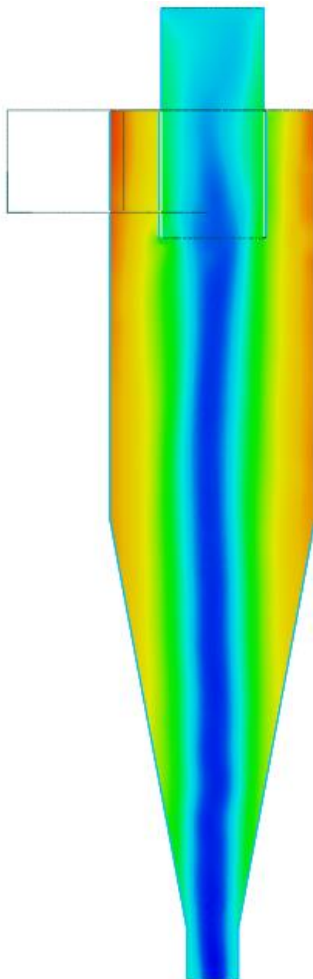
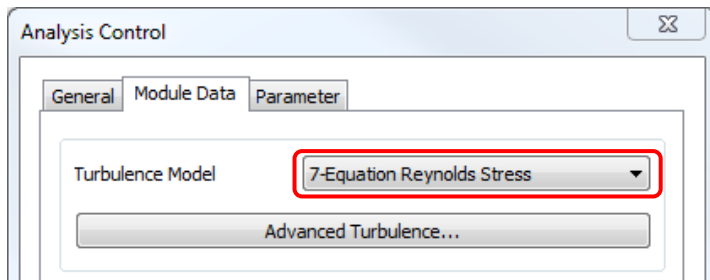
Buttons: Add... (Right click)



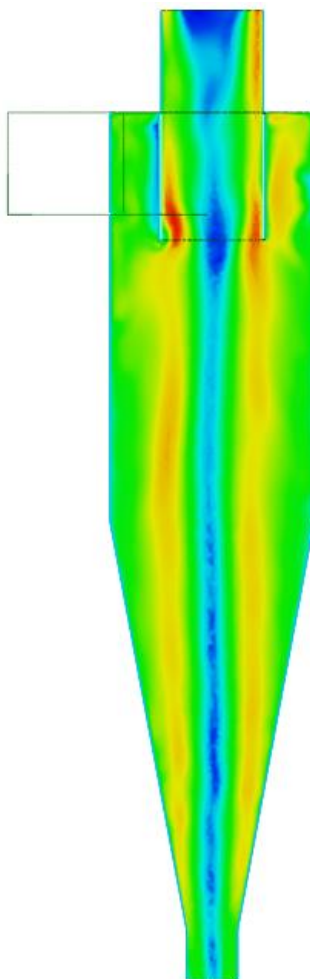
# Reynolds stress turbulence model

## < Development Purpose and Usage Method >

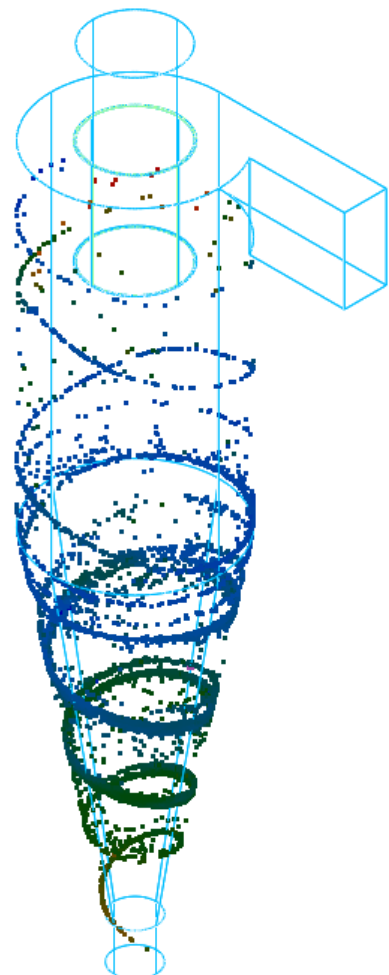
Reynolds stress turbulence model has been added. Model is suitable for vortex flow with biased characteristics like cyclone. Unlike previous models that model Reynolds stress through turbulent viscosity, it directly reflects the six independent components of the Reynolds stress tensor. We can overcome the fundamental limitation of isotropic turbulence assumption that turbulent viscosity models have. When using the Reynolds stress turbulence model, we recommend using the hybrid (accuracy) method for the element application formula in the analytical control option.



(a) Pressure distribution



(b) Velocity distribution



(c) Particle distribution

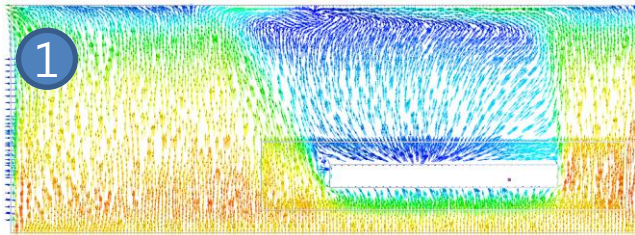
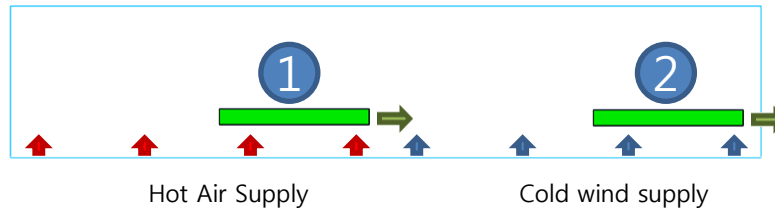
Cyclone analysis using Reynolds stress model

# Overset Mesh - 3D Solid Elements

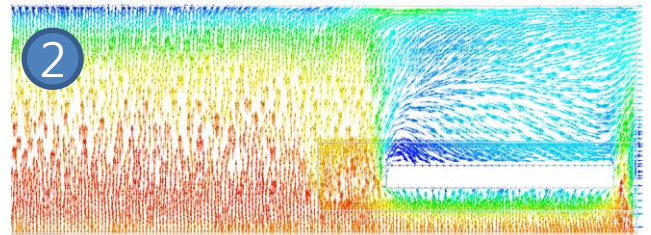
## < Development Purpose and Usage Method >

Existing overset mesh feature could not contain solid elements. For example, heating of objects by hot air was impossible to simulate.

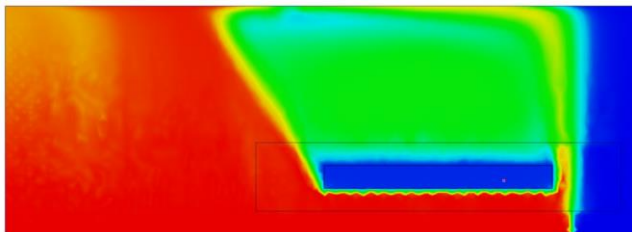
The NFX 2019R1 release improves overset mesh functionality to include solid elements.



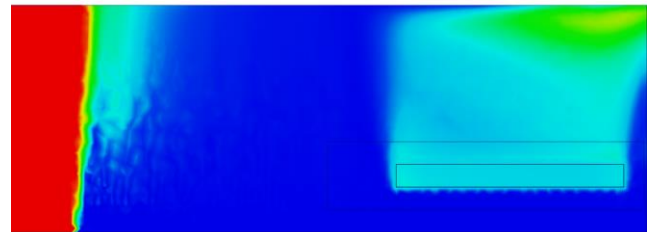
Flux flow



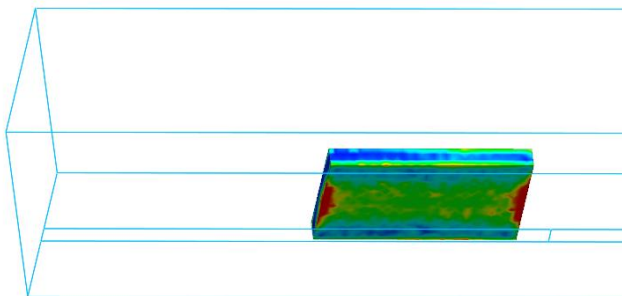
Flux flow



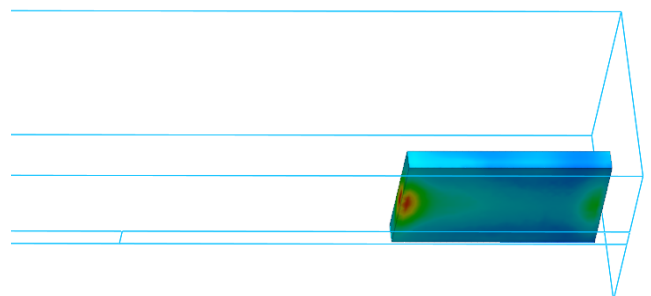
Center cross-sectional temperature distribution



Center cross-sectional temperature distribution



Solid bottom temperature distribution

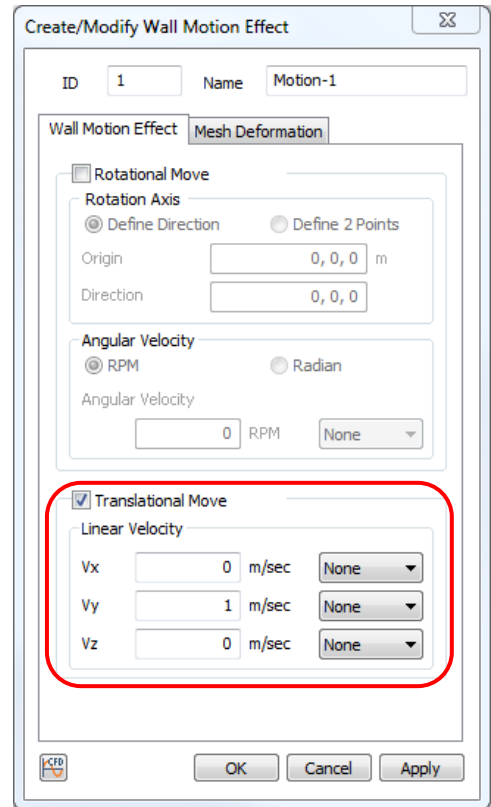
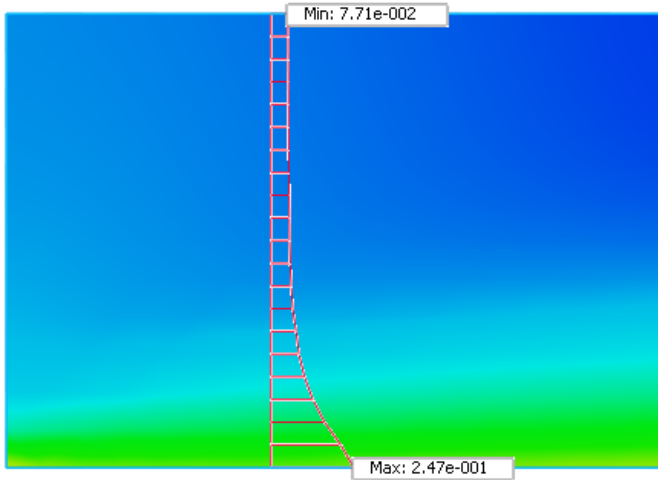


Solid bottom temperature distribution

# Wall Translational Motion

## < Development Purpose and Usage Method >

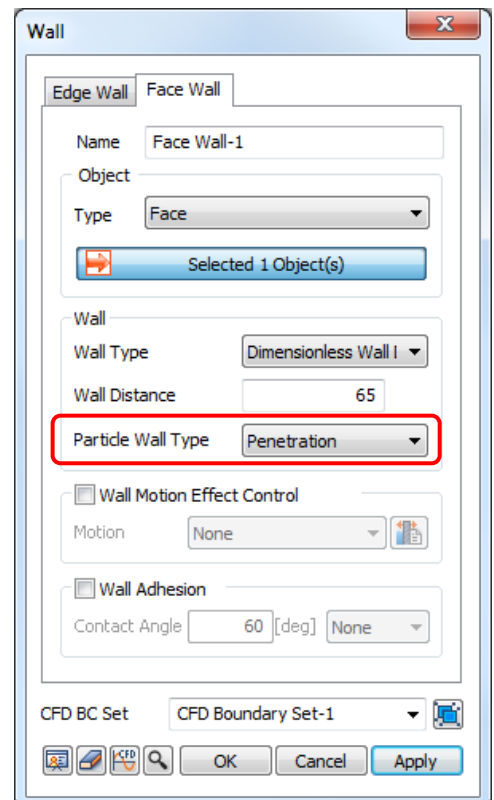
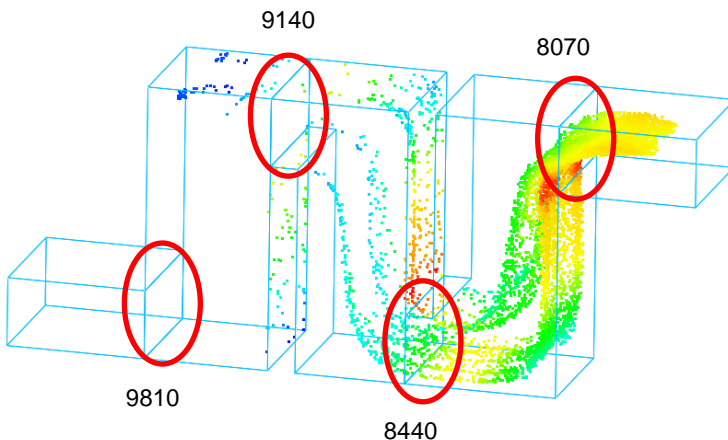
The newly added translational wall motion effect gives you wall speed with applied wall laws when the wall moves in the translation direction.



# Penetration- Particle Wall Type

## < Development Purpose and Usage Method >

This wall option allows to define surface through which the fluid and particles can freely pass. Use this to determine the number of particles that pass through that face.

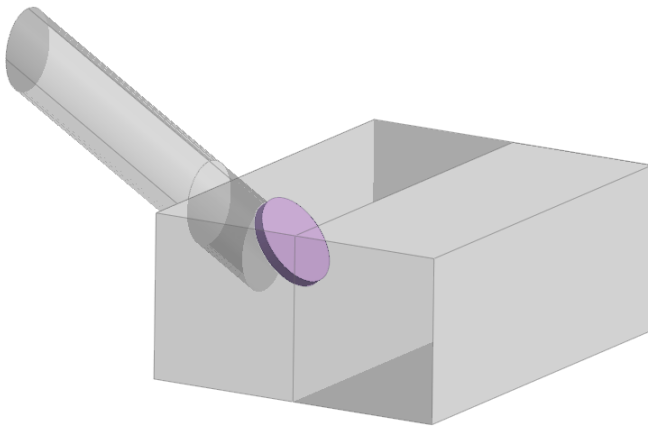


# CFD-Spring/Damper system

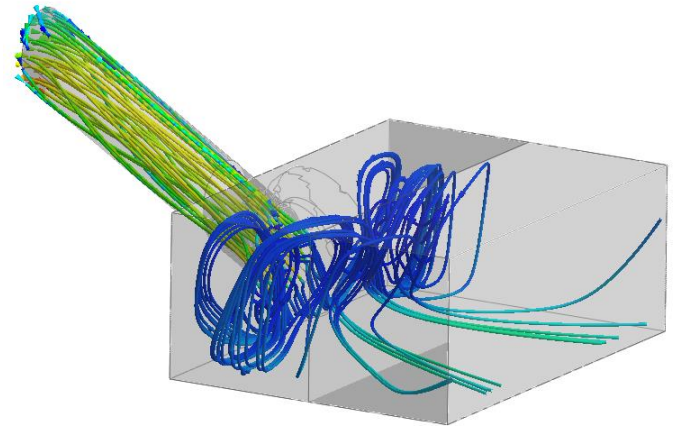
## < Development Purpose and Usage Method >

The newly developed overlapping mesh function can analyze motion caused by the fluid force of an object connected to a spring-damper system.

Spring constant input (constant or function)  
 Damper constant input (constant or function)  
 Limited range of motion



Swing check valve model

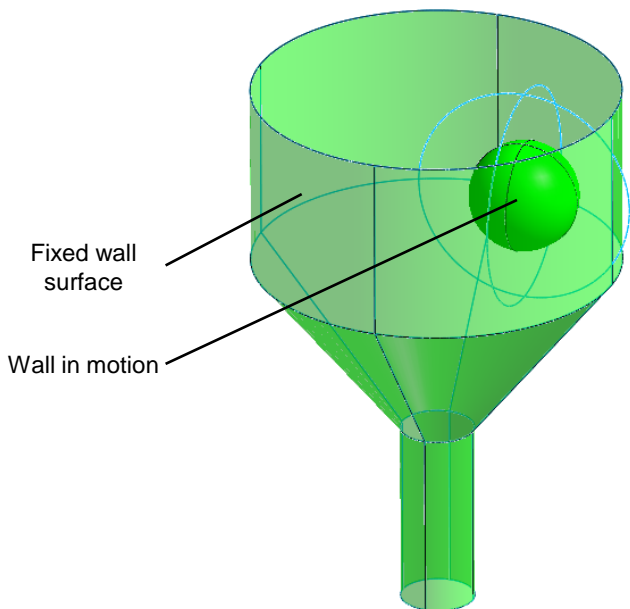
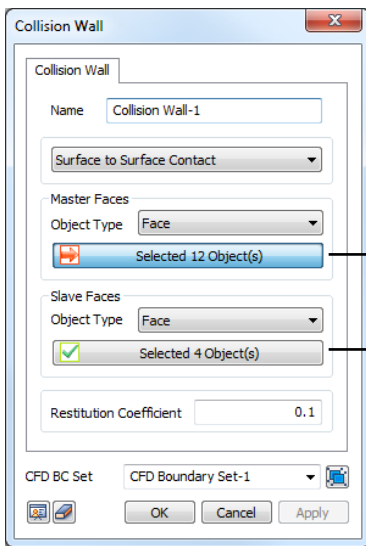


Swing check valve analysis result (streamlines)

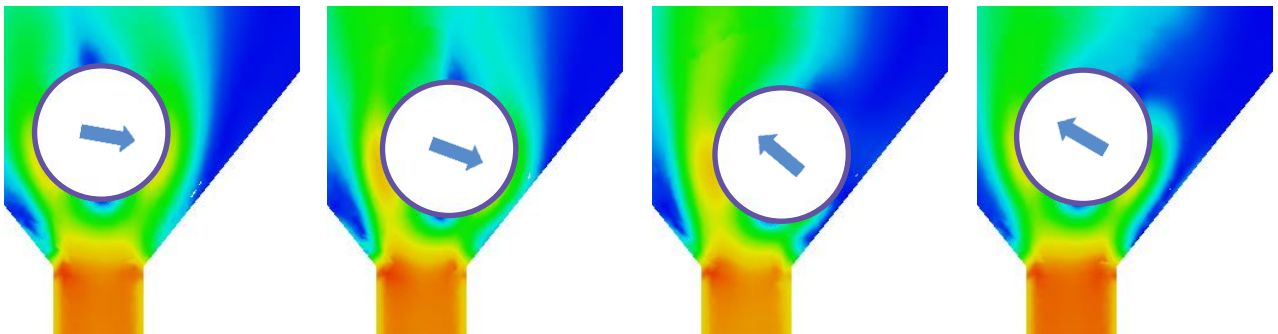
# Collision Wall

## < Development Purpose and Usage Method >

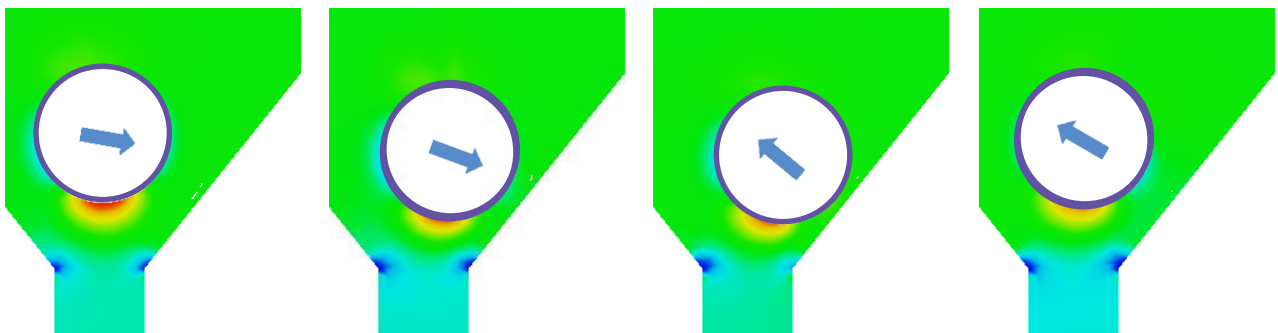
Collision between wall and wall can occur when analyzing simultaneous flow and free motion of a nested mesh. At this time, it is possible to simulate the collision after the collision between the walls registered by the collision wall function. Consider the coefficient of restitution to calculate energy conservation after impact.



## Velocity Contour



## Pressure Contour



Initial model

0.01 sec

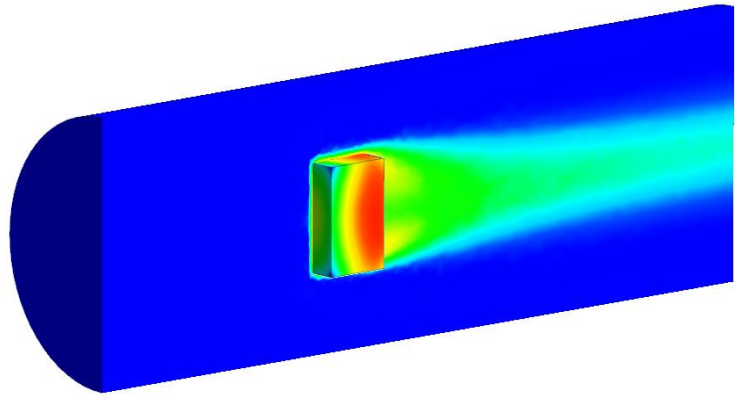
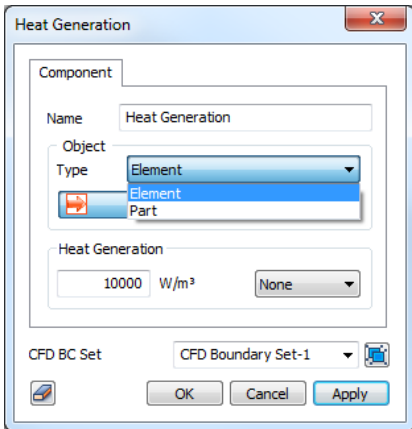
0.02 sec

0.03 sec

# Heat Source - Volumetric heat

## < Development Purpose and Usage Method >

In the conventional complex heat transfer analysis, the volume calorific value was entered at the stage of defining the material. The "heat" function of the midas NFX 2019R1 is more convenient because it can give different calorific values for each element or part (independent volume).

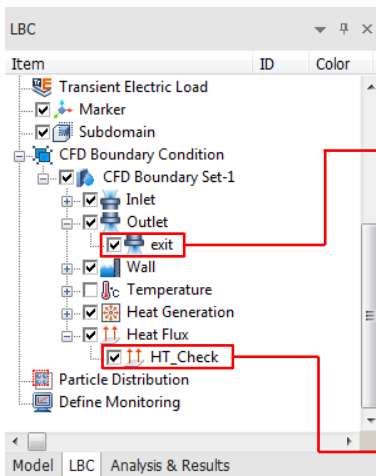


Apply heat to an element or part

# New CFD function parameters

## < Development Purpose and Usage Method >

Parameters that can be used in the fluid analysis function have been added. By including heat flux, node area, and node volume in the function, it is possible to utilize more functional flow analysis function. The heat flux output and the nodal area output refer to the user-defined boundary condition name because the boundary must be specified.



Nodal area output function

**nar('exit')**

Nodal volume output function

**nvol**

Heat flux output function

**flx('HT\_check')**

## Examples

**nar('exit')\*(-vx)\*(tm-25)**

**nvol\*sqrt(vx\*vx+vy\*vy+vz\*vz)\*(tm-25)**

**if(tm=25)then(0)else(flx('HT\_check')/(tm-25))endif**