

Release Note

Release Date : December 2021

Product Ver. : FEA NX 2022 (v1.1)



ADVANCED NONLINEAR AND DETAIL

New Paradigm in Advanced Structural Analysis

Enhancements

1. Add Material Database for Concrete/Steel
2. Add Arc Length Method for Construction Stage Analysis
3. Improvement of Measure Function
4. Unit Conversion of Eigenvalue Analysis Results
5. Improvement of Results Diagram
6. Improvement of Non-spatial Function for Temperature-Dependent Property
7. Import Nastran Model File
8. Improvement of Surface Spring (Normal/Shear Elastic Link Type)
9. Generate Max/Min/Absolute Max Results of Thermal Stresses
10. Generate Damper Condition at the Bottom of the Ground




1. Add Material Database for Concrete/Steel

- ASTM, EN, UNI, IS, BS, CSA, CNS, AS/NZS, GOST, and more.

▪ Mesh > Prop./CSys./Func. > Material > Isotropic

Material

ID 1 Name Isotropic Color 

Model Type Elastic Structure

General Thermal Time Dependent Temperature Dependent


Elastic Modulus(E) 2.7085e+010 N/m² ...

Inc. of Elastic Modulus 0 N/m²

Inc. of Elastic Modulus Ref. Height 0 m


Poisson's Ratio(ν) 0.2

Unit Weight(γ) 25000 N/m³

Basic Properties Direct Input Using Code 

Initial Stress Parameters

Ko Determination 1

Automatic Manual Anisotropy 

Thermal Parameter

Thermal Coefficient 1.2e-005 1/[T]

Molecular vapor diffusion coefficient 0 m²/sec

Thermal diffusion enhancement 0

Damping Ratio(For Dynamic)

Damping Ratio 0.05

Safety Result(Mohr-Coulomb)

Cohesion(C) 30000 N/m²

Frictional Angle(ϕ) 36 [deg]

Tensile Strength 0 N/m²

Update according to the database

Material DB

Type Concrete

Standard EN04(RC)

Code

DB C35/45

Concrete

Material DB

Type Steel

Standard ASTM(S)

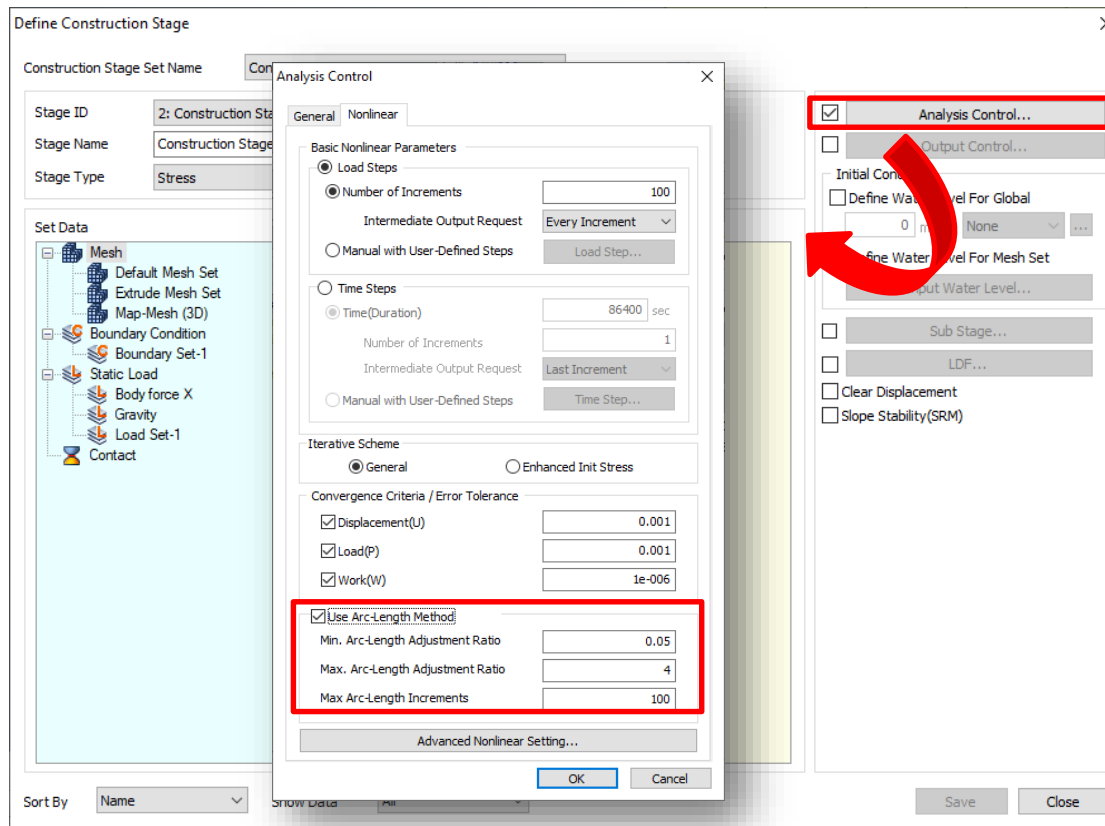
DB A53

Steel

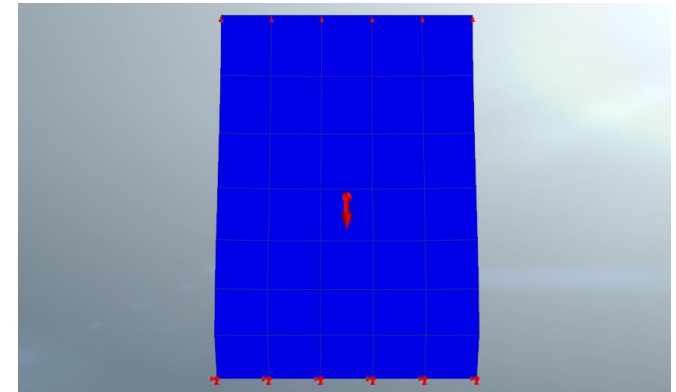
2. Add Arc Length Method for Construction Stage Analysis

- The Arc Length method is introduced for the construction stage analysis to support sequential loadings (i.e., lateral loads after self-weight.).
- The Arc Length method promises to solve highly nonlinear systems of equations efficiently and accurately even when the Newton method fails.

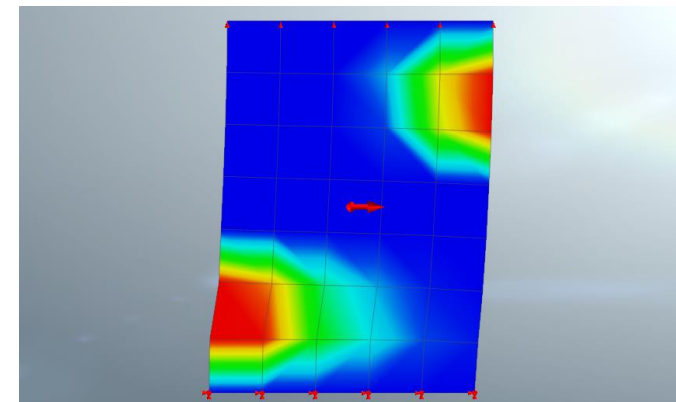
Construction Stage > Define Construction Stage > Analysis Control



Define Construction Stage



Stage 1: Apply gravity loads

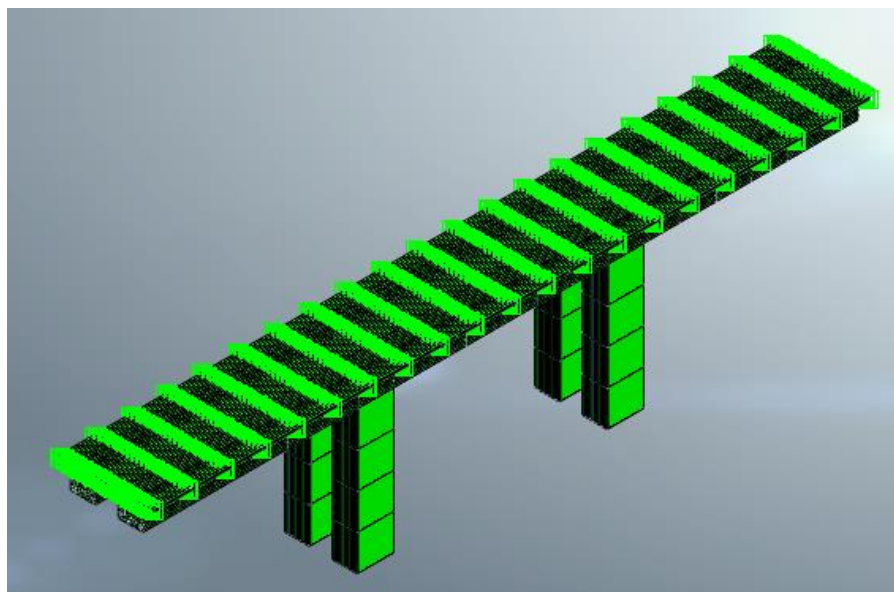
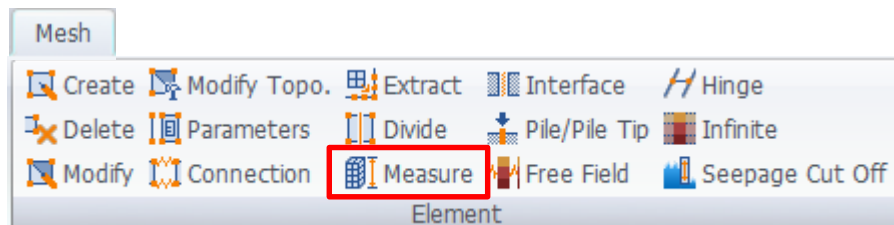


Stage 2: Apply lateral loads

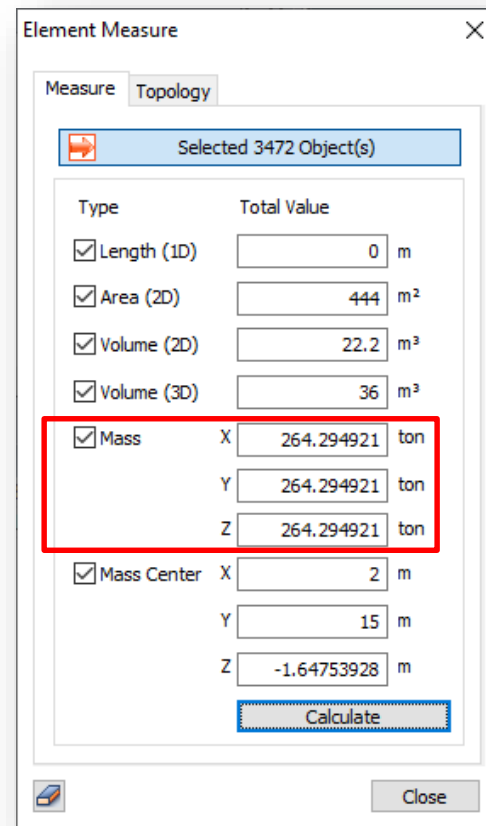
3. Improvement of Measure Function

- Mass data can be viewed in the X, Y, and Z axis separately.

▪ **Mesh > Element > Measure**



Structural Mass and Loads to Mass

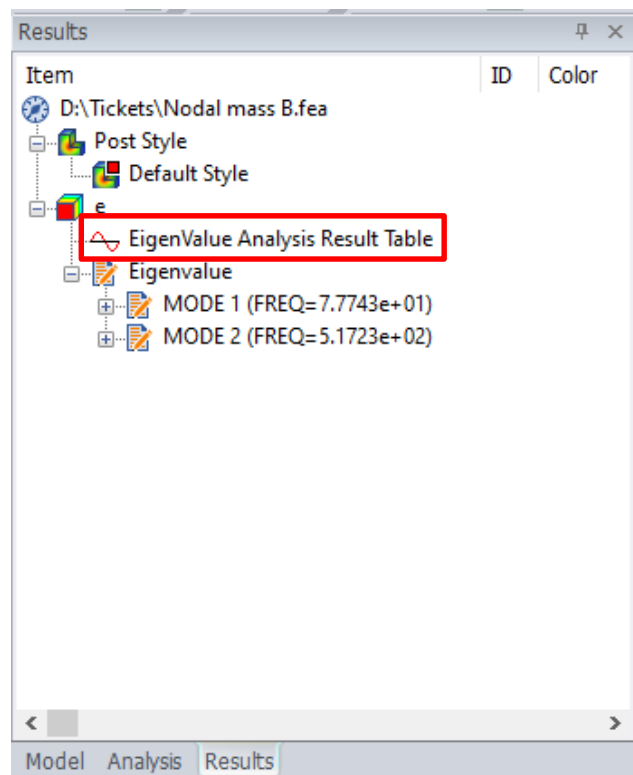


Element Measure

4. Unit Conversion of Eigenvalue Analysis Results

- Modal effective masses and modal participation factors are provided depending on the unit system selected by the user.
- Previously, the values were always calculated with the N, m unit.

▪ **Post > Results > Eigenvalue Analysis Result Table**



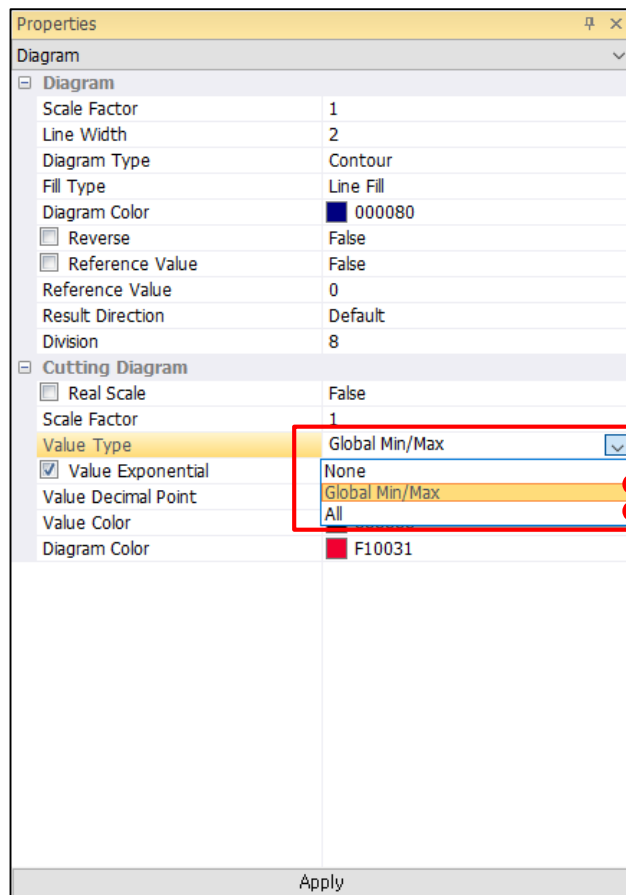
REAL EIGENVALUES									
MODE NUMBER	EIGENVALUE	RADIANS	CYCLES	PERIOD	GENERALIZED MASS	GENERALIZED STIFFNESS	ORTHOGONALITY LOSS	ERROR MEASURE	
1	2.386048e+005	4.884719e+002	7.774272e+001	1.286294e-002	1.000000e+000	2.386048e+005	0.000000e+000	0.000000e+000	
2	1.056140e+007	3.249830e+003	5.172265e+002	1.933389e-003	1.000000e+000	1.056140e+007	0.000000e+000	0.000000e+000	
MODAL EFFECTIVE MASS									
MODE NUMBER	T1	T2	T3	R1	R2	R3			
1	1.581238e-001	0.000000e+000	0.000000e+000	0.000000e+000	1.002773e+000	0.000000e+000			
2	4.187618e-002	0.000000e+000	0.000000e+000	0.000000e+000	1.285185e-002	0.000000e+000			
TOTAL	2.000000e-001	0.000000e+000	0.000000e+000	0.000000e+000	1.015625e+000	0.000000e+000			
TOTAL IN MODEL	2.000000e-001	0.000000e+000	0.000000e+000	0.000000e+000	1.015625e+000	0.000000e+000			
PERCENTAGE MODAL EFFECTIVE MASS									
MODE NUMBER	T1	T2	T3	R1	R2	R3			
1	79.06%	0.00%	0.00%	0.00%	98.73%	0.00%			
2	20.94%	0.00%	0.00%	0.00%	1.27%	0.00%			
TOTAL	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%			
MODAL DIRECTION FACTOR									
MODE NUMBER	T1	T2	T3	R1	R2	R3			
1	44.47%	0.00%	0.00%	0.00%	55.53%	0.00%			
2	94.30%	0.00%	0.00%	0.00%	5.70%	0.00%			
MODAL PARTICIPATION FACTOR									
MODE NUMBER	T1	T2	T3	R1	R2	R3			
1	3.976479e-001	0.000000e+000	0.000000e+000	0.000000e+000	1.001386e+000	0.000000e+000			
2	2.046367e-001	0.000000e+000	0.000000e+000	0.000000e+000	-1.133660e-001	0.000000e+000			

Eigenvalue Analysis Result Table

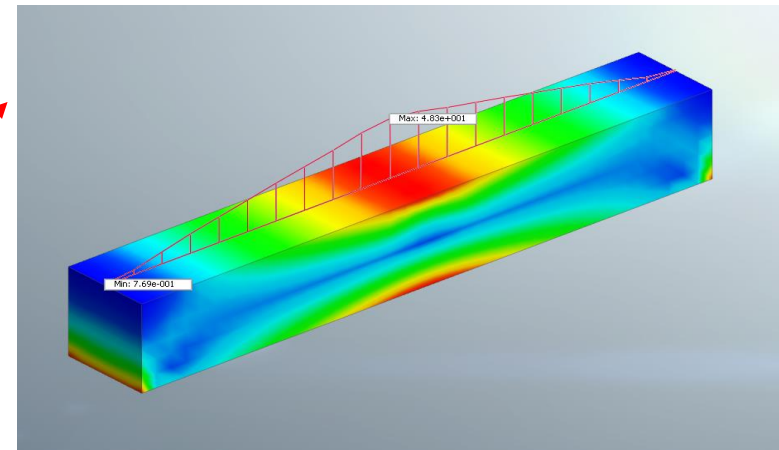
5. Improvement of Results Diagram

- The values can be viewed at all the node positions in the results diagram.
- Previously, the minimum and maximum values could only be displayed.

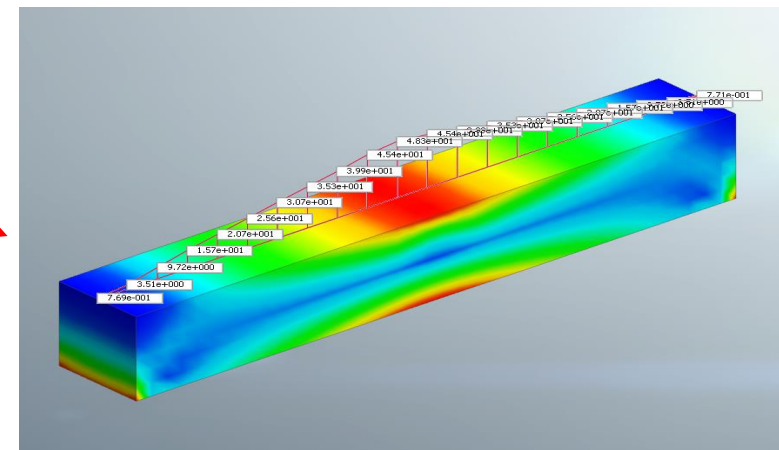
Post > Properties > Diagram > Value Type



Properties > Diagram



FEA NX 2021: Min/Max value only

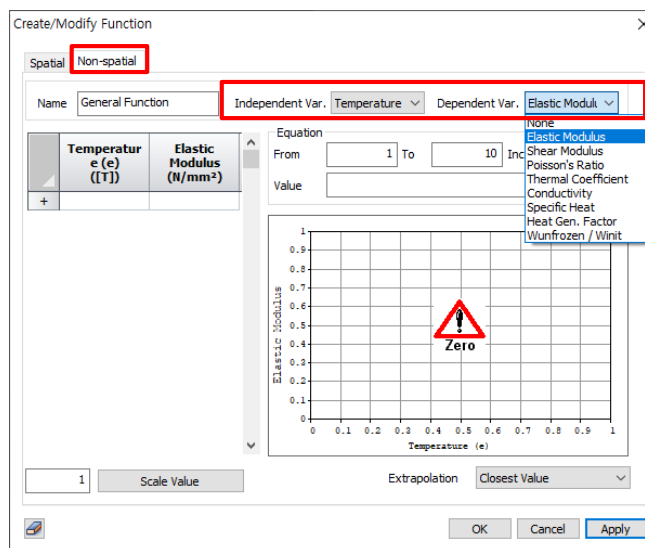
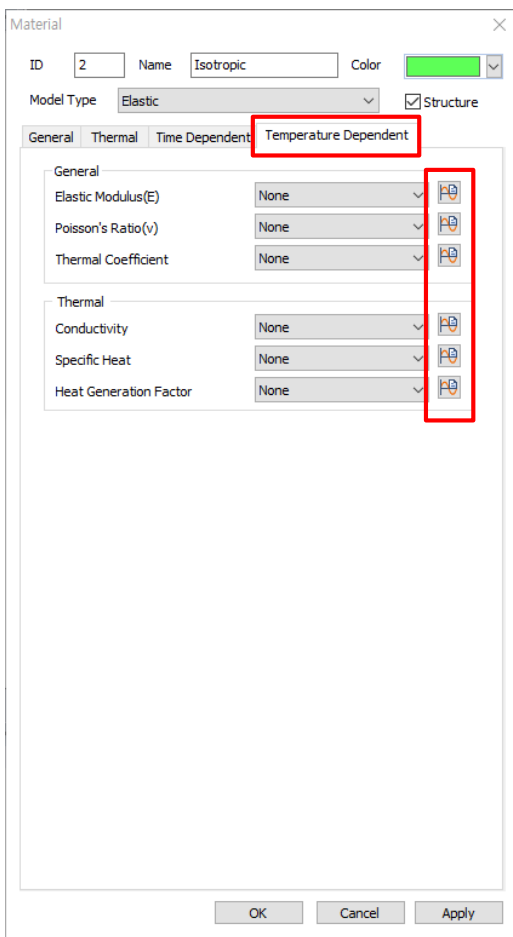


FEA NX 2022: Min/Max or All Values

6. Improvement of Non-spatial Function for Temperature-Dependent Property

- Define the function for the temperature-dependent properties based on the current unit system. Enter the values as an absolute value rather than a scale factor.

Mesh > Prop./CSys./Func. > Material > Temperature Dependent



Non-spatial Function

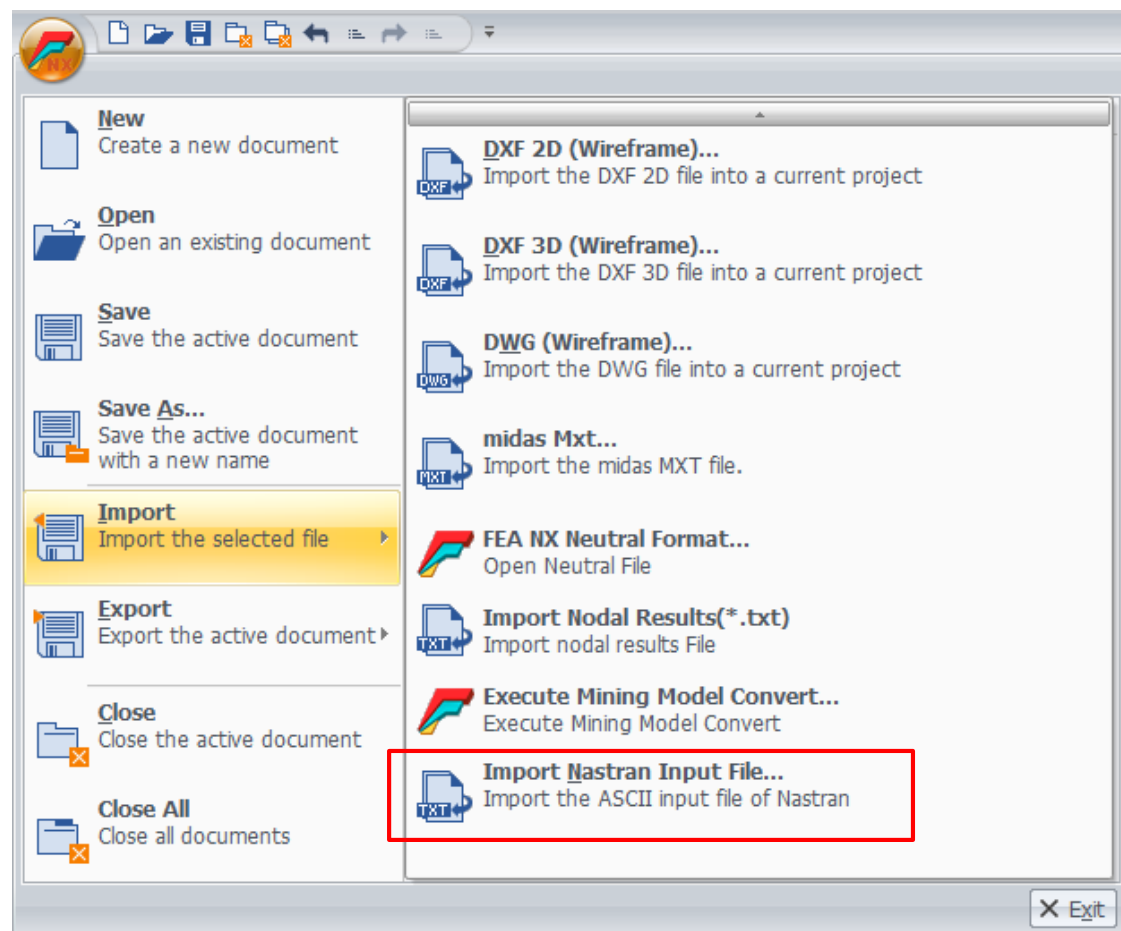
Independent Variable	Dependent Variable	Current Unit
Strain/Stretch Temperature	None	-
	None	-
	Elastic Modulus	N/mm ²
	Shear Modulus	N/mm ²
	Poisson's Ratio	-
	Thermal Coefficient	-
	Conductivity	W/(mm*[T])
	Specific Heat	J/(kg*[T])
Displacement	Heat Gen. Factor	-
	Wunfrozen/Winit	-
	Force/Length	N/mm
Stress	Force/Area	N/m ²
	Force	N
	None	-

Temperature Dependent Properties

7. Import Nastran Model File

- Nastran input file can be imported into FEA NX.

- **File > Import > Import Nastran Input File...**



Import Files

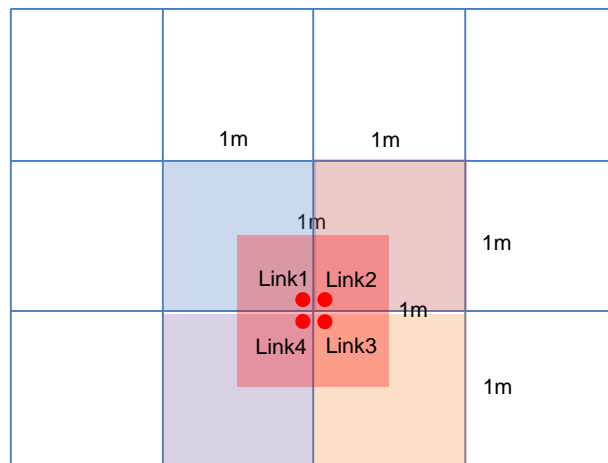
8. Improvement of Surface Spring (Normal/Shear Elastic Link Type)

- The stiffness of the link is determined based on the area supported by each links.

▪ Mesh > Element > Create > Other > Surface Spring

Surface Spring

FEA NX 2021

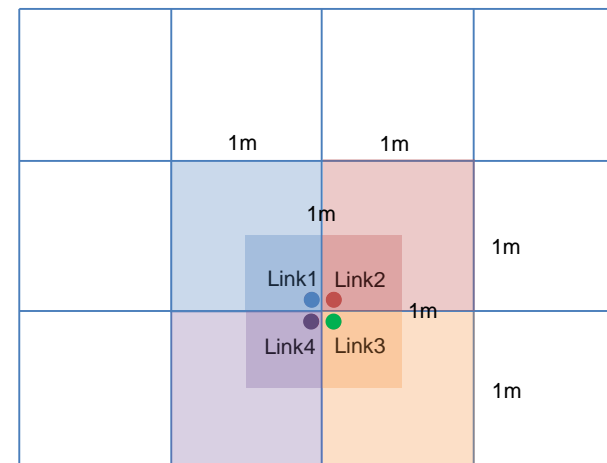


The stiffness corresponding to the red box area was assigned to the Elastic Link 1, 2, 3, and 4 without dividing by four.

$$\begin{aligned} \text{Link1: } & 1\text{N/m}^3 * 1\text{m}^2 = 1\text{N/m} \\ \text{Link2: } & 1\text{N/m}^3 * 1\text{m}^2 = 1\text{N/m} \\ \text{Link3: } & 1\text{N/m}^3 * 1\text{m}^2 = 1\text{N/m} \\ \text{Link4: } & 1\text{N/m}^3 * 1\text{m}^2 = 1\text{N/m} \end{aligned}$$

The stiffness was four time larger than the actual stiffness.

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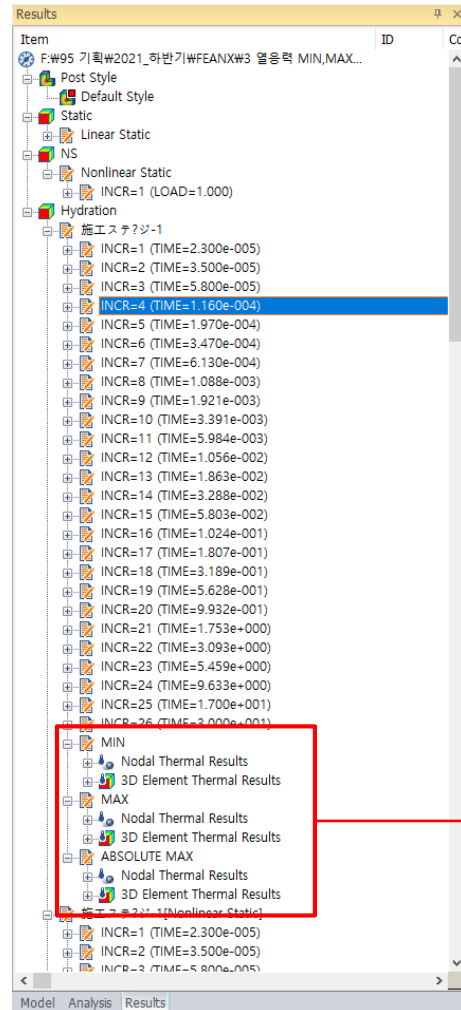
The stiffness corresponding to the area supported by each links is assigned to the Elastic Link 1, 2, 3, and 4.

$$\begin{aligned} \text{Link1 : } & 1\text{N/m}^3 * 0.25\text{m}^2 = 0.25\text{N/m} \\ \text{Link2 : } & 1\text{N/m}^3 * 0.25\text{m}^2 = 0.25\text{N/m} \\ \text{Link3 : } & 1\text{N/m}^3 * 0.25\text{m}^2 = 0.25\text{N/m} \\ \text{Link4 : } & 1\text{N/m}^3 * 0.25\text{m}^2 = 0.25\text{N/m} \end{aligned}$$

9. Generate Max/Min/Absolute Max Results of Thermal Stresses

- Check the envelope of the thermal stresses among all the stages in the heat of hydration analysis.

- **Post > Results > Hydration**

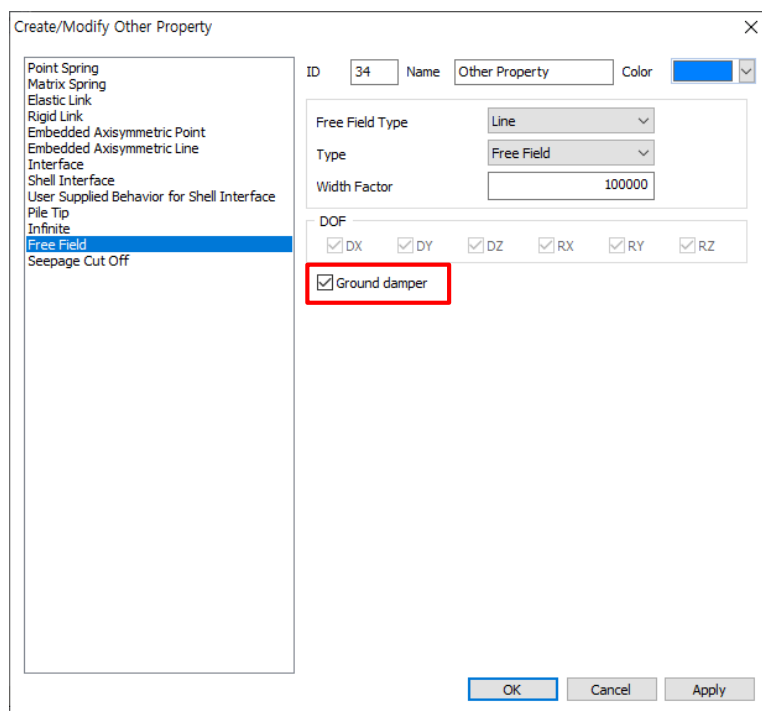


- Generate Max/Min/Absolute Max values of the thermal stresses throughout the stages.

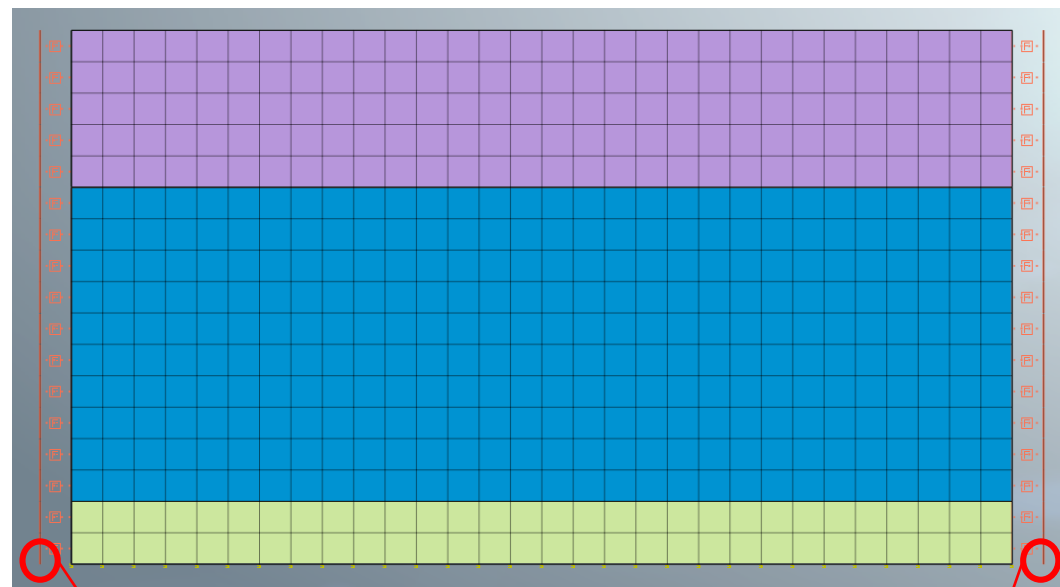
10. Generate Damper Condition at the Bottom of the Ground

- Generate the damper condition at the bottom of the free field.

- **Mesh > Prop./CSys./Func. > Property > Other... > Free Field**



Property > Free Field



- Generate damper condition at the bottom of Free Field
- Damper can be displayed after analysis.

10. Generate Damper Condition at the Bottom of the Ground

- Generate the damper condition along the bottom edge of the selected mesh set.

- **Mesh > Element > Create > Other > Ground Surface Spring**

Element Create/Delete

1D 2D 3D Other Delete

Ground Surface Spring

Select Mesh Set(s)

Ground Surface Spring

Modulus of Subgrade Reaction

Modulus of elasticity coeff. a

Damping Constant/Area

Only Bottom Condition

Boundary Set

Fixed Bottom Condition

Stat

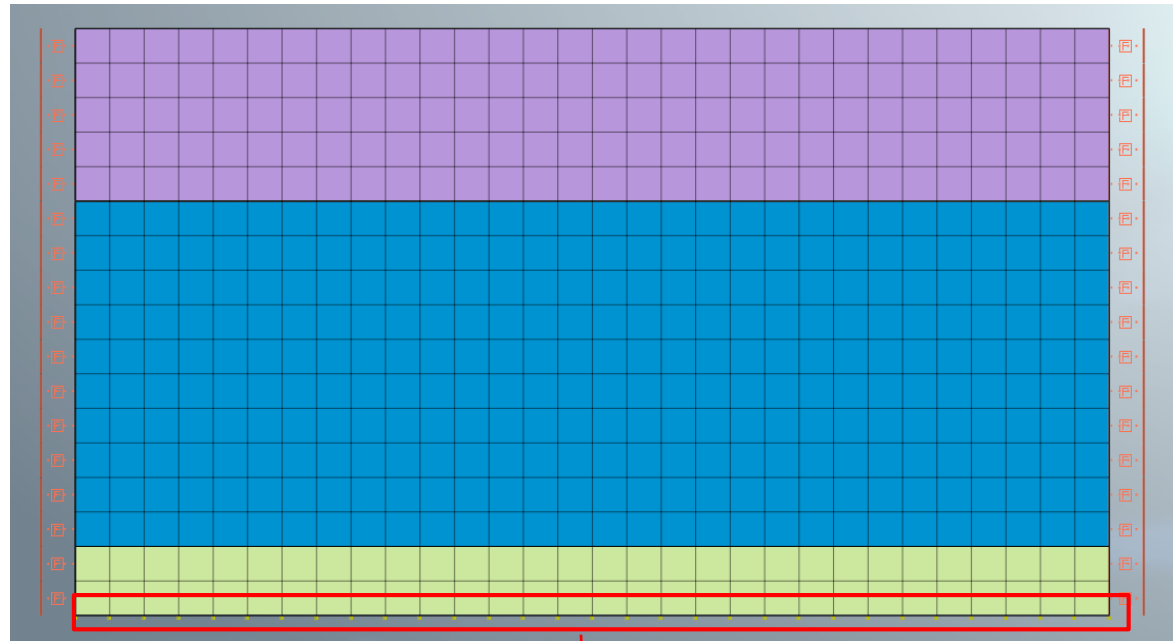
Property

5 5: PontSpring

Mesh Set Ground Surface Spring

OK Cancel Apply

* Check off 'Fixed Bottom Condition'.



- Generate damper condition at the bottom of the mesh set.