Release Note

FEA 2016 (v1.1)
Release date: June 25, 2015

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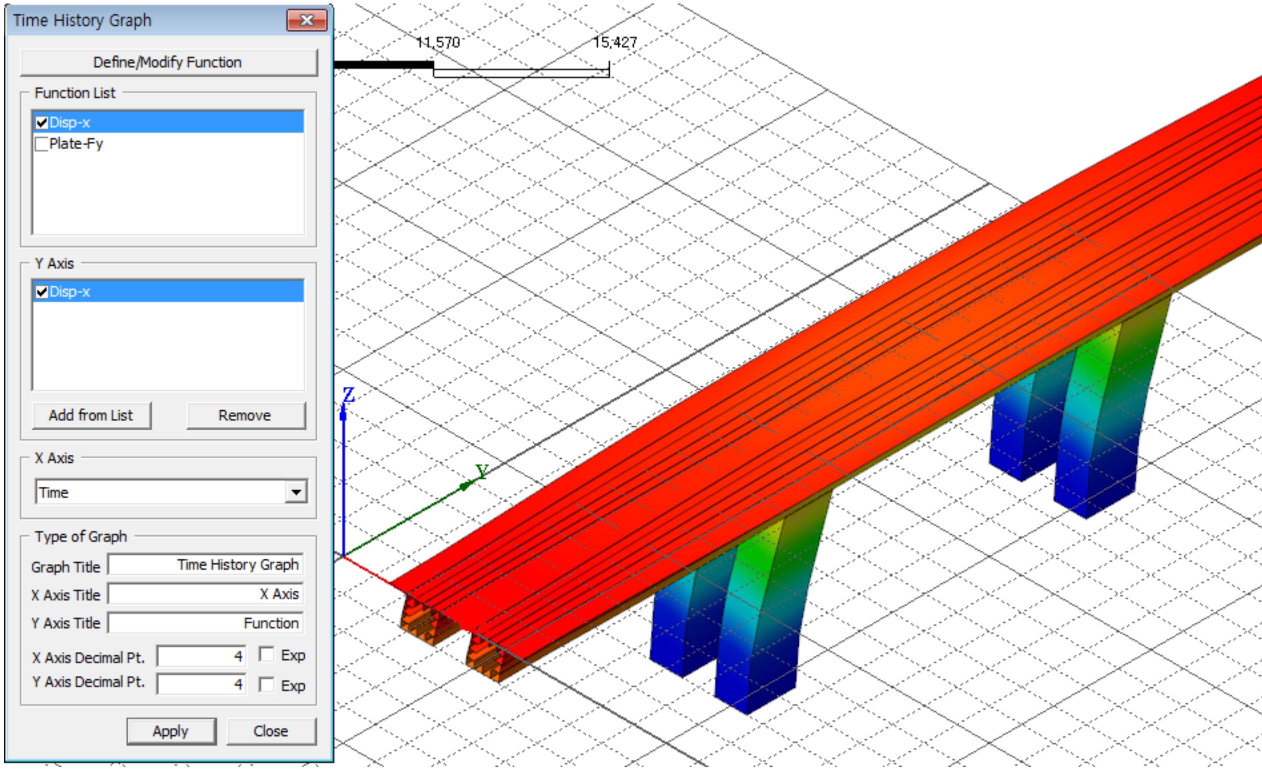
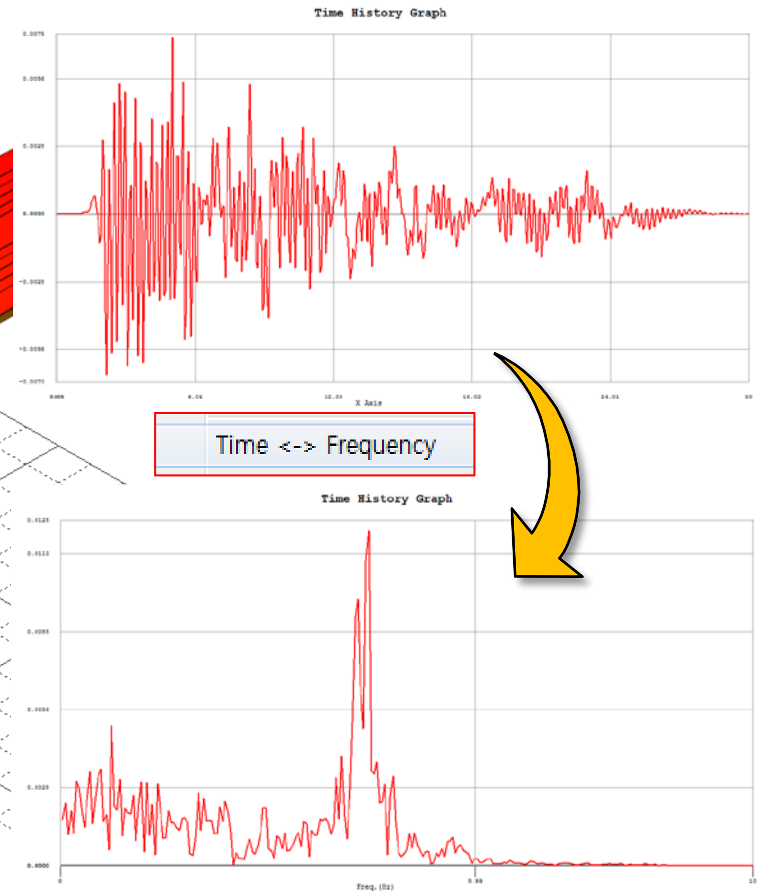
(1) Fast Fourier Transform in Time-history Graph





- Menu: Post > Time History Analysis > Time History Graph (Time ↔ Frequency)

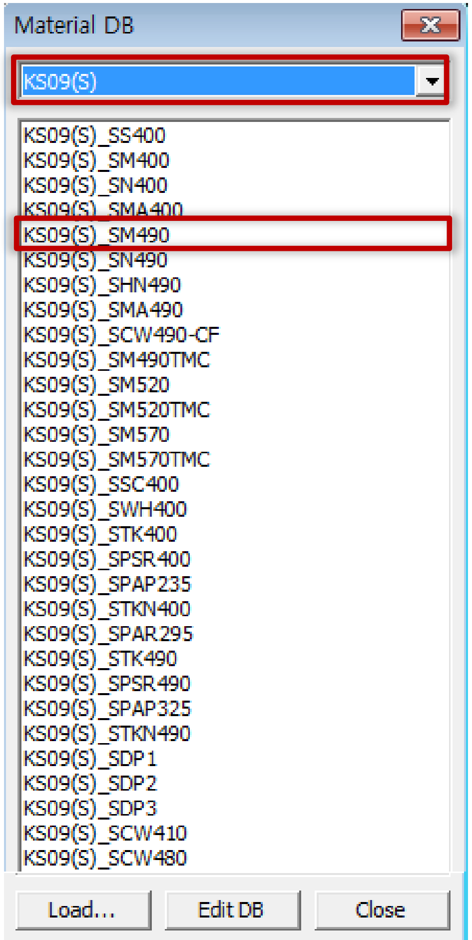
Upgrade Contents

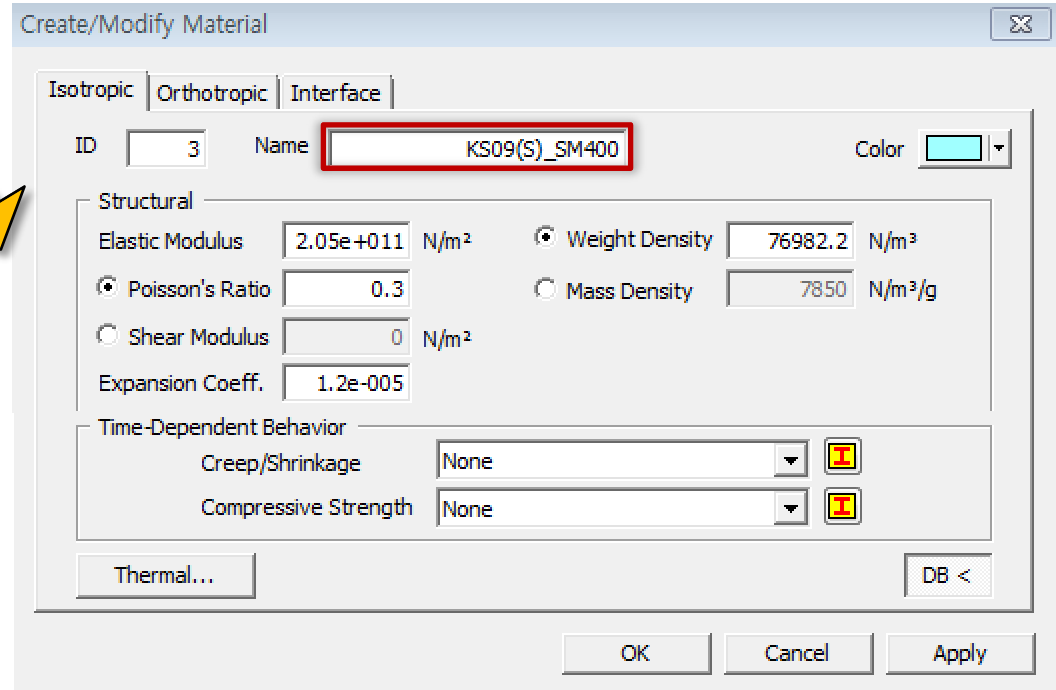
- Using the Fast Fourier Transform algorithm, time history graphs can be converted to frequency history graphs and vice versa.

Effects & Usage

- Vibrations of footbridges or building floors due to walking loads can be checked in the frequency domain using FFT so that resonance frequency can be found.

(2) New Material DB to Korean Standard



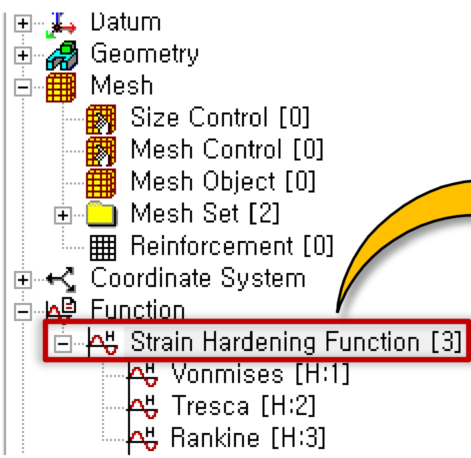


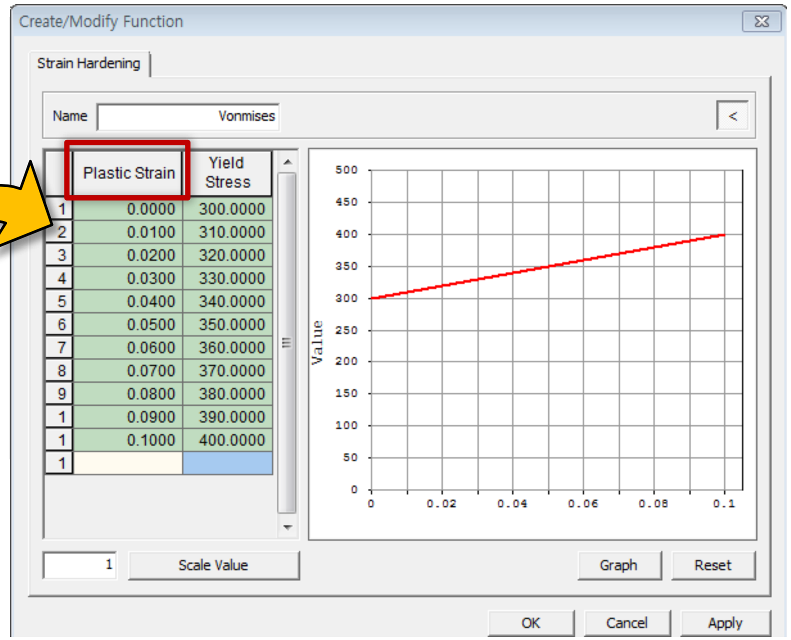
- Meun: Analysis>Material Manager>Create/Modify Material>Material DB

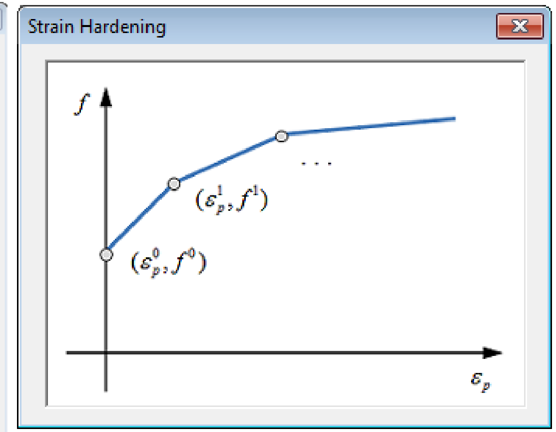
Upgrade Contents

- KSCE-LSD12(RC), KS09(S), KS08(S), KSCE-LSD12(S), KS10-Civil(S), KS08-Civil(S)

(3) New Method of Defining Yield Stress–Strain Relations







- Menu: Analysis>Material

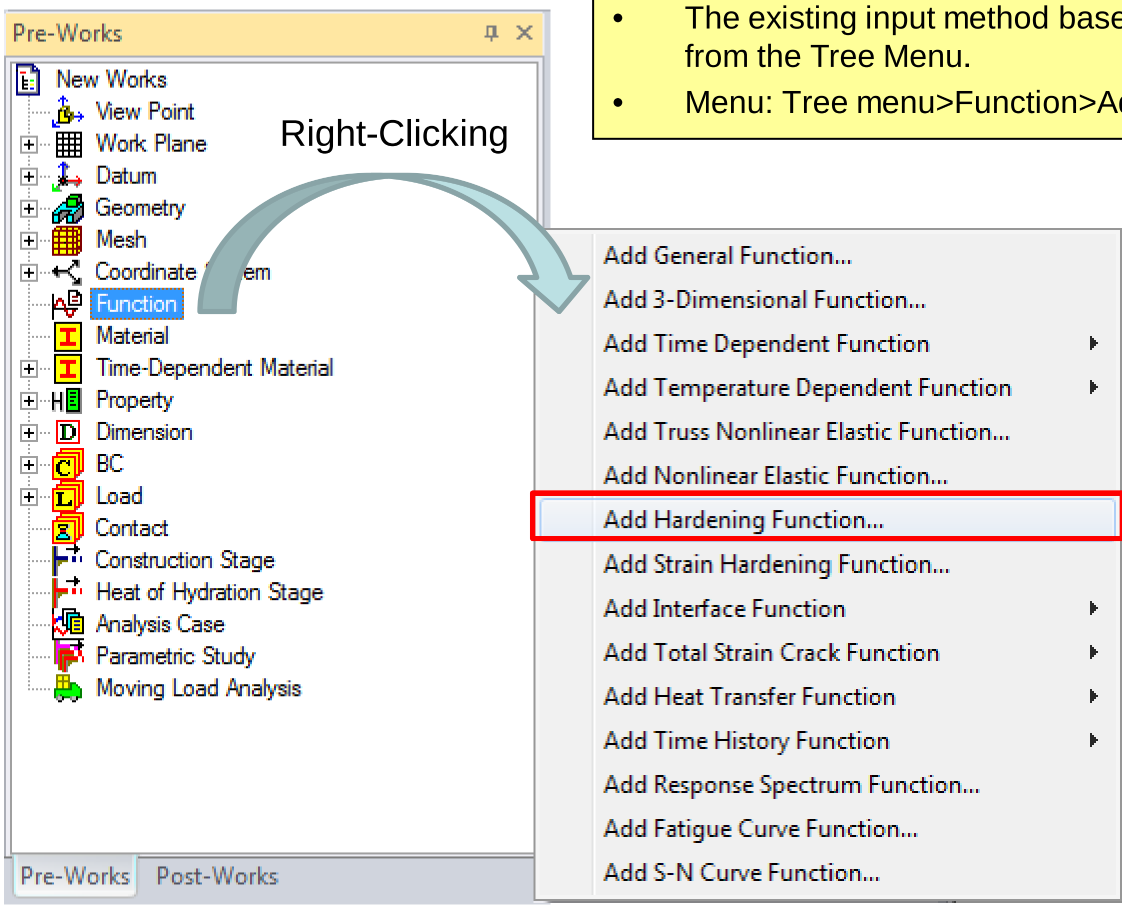
Upgrade Contents

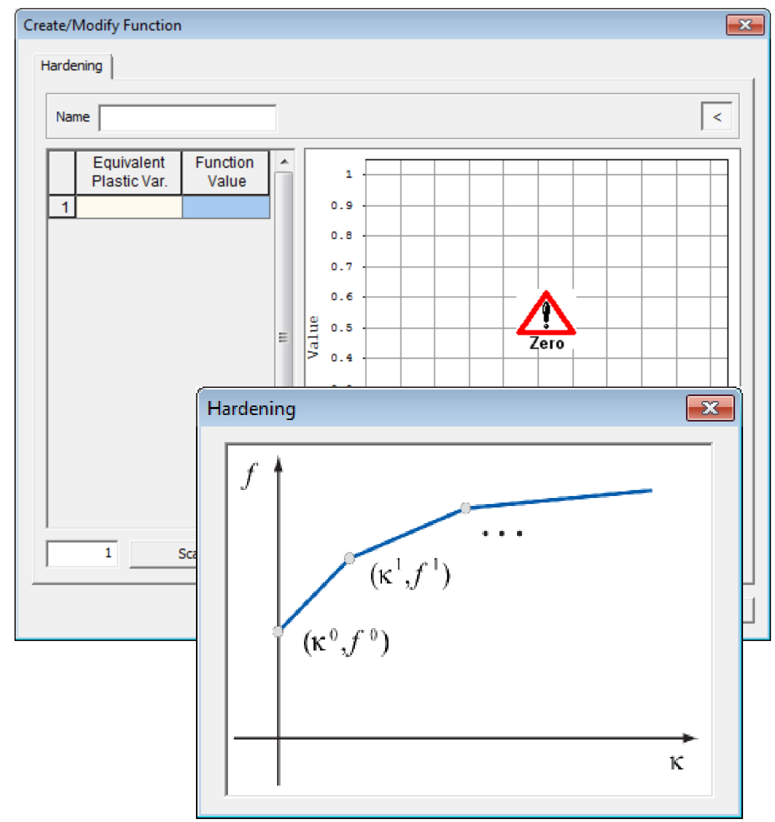
- In the case of plastic materials, the constitutive model defines an elastic limit as a function of the equivalent plastic strain, which can be calculated based on the plastic strain obtained from the uni-axial tension test as follows. In the new version, the strain hardening can be defined based on the uni-axial plastic strain. The program will automatically convert it into the equivalent plastic strain.

- von Mises $\kappa = \lambda = \varepsilon_1^p$ - Tresca $\kappa = \frac{2}{\sqrt{3}}\lambda = \frac{2}{\sqrt{3}}\varepsilon_1^p$ - Rankine $\kappa = \sqrt{\frac{2}{3}}\lambda = \sqrt{\frac{2}{3}}\varepsilon_1^p$

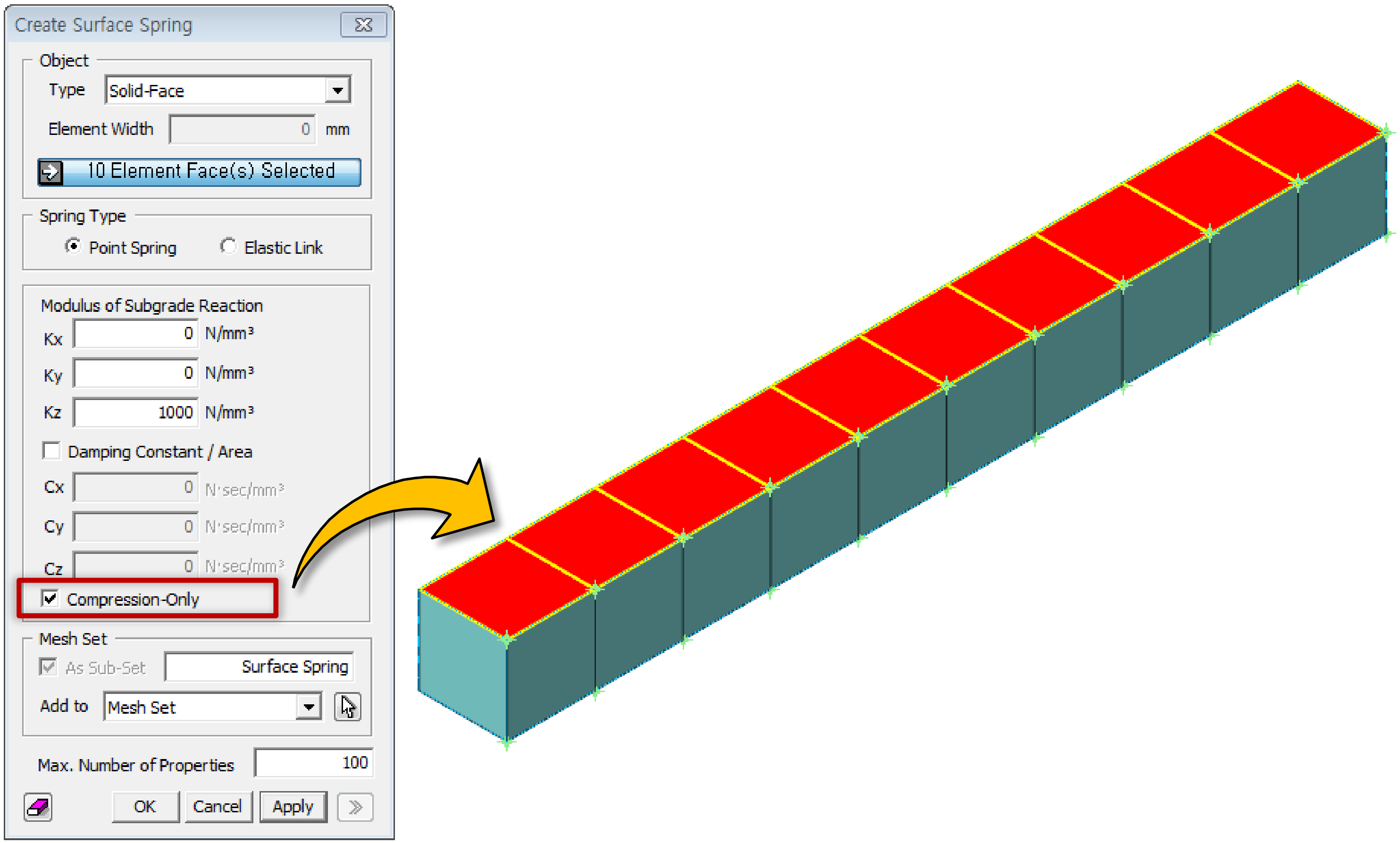
κ: Equivalent plastic strain ε_1^p Uniaxial plastic strain

- The existing input method based on Equivalent Plastic Strain can be accessed from the Tree Menu.
- Menu: Tree menu>Function>Add Strain Hardening Function





(4) Compression-only Point Spring for Soil Resistance

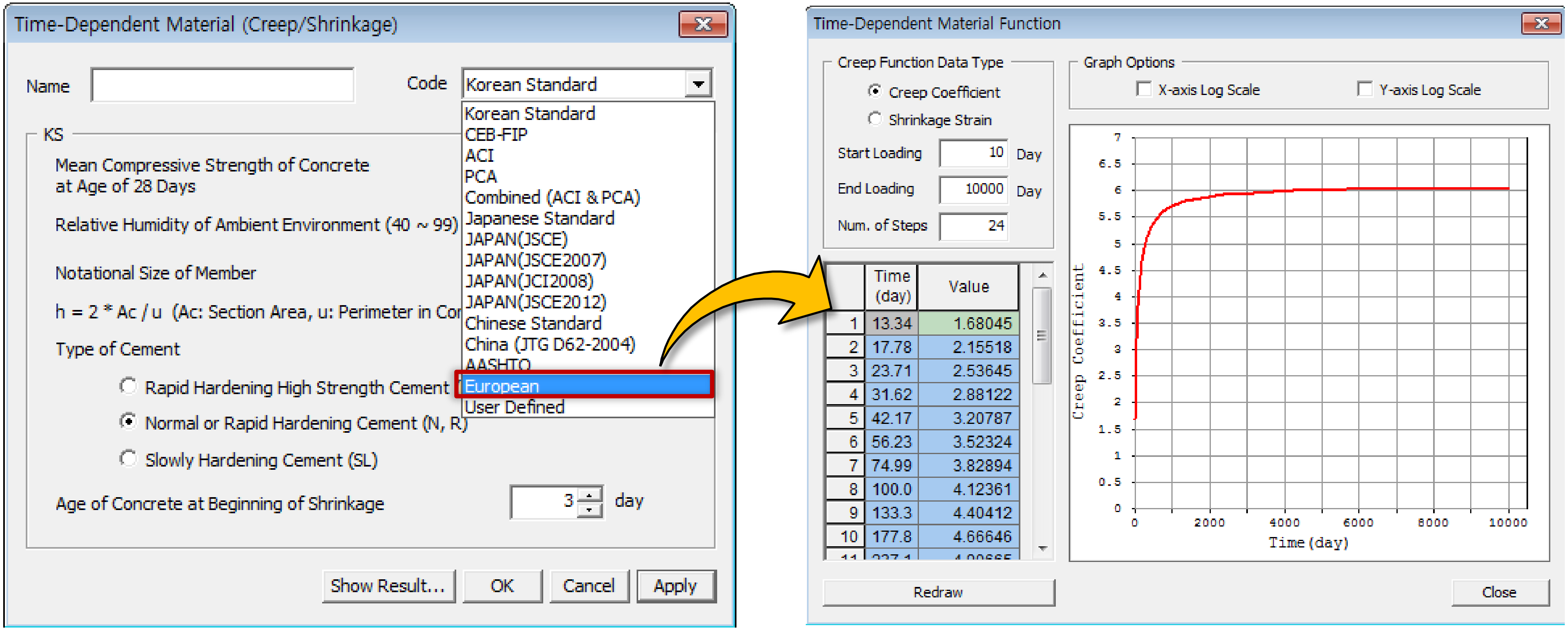


- Menu: Mesh>Element>Create Surface Spring>Point Spring

Upgrade Contents

- Point Spring with Compression-Only type can simulate the elastic behavior of soil resistance.

(5) Time Dependent Material to Eurocode



- Menu: Analysis>Time Dependent Material>Creep/Shrinkage, Compressive Strength

Upgrade Contents

- Prestressed structures can be analyzed with the effects of creep, shrinkage and compressive strength to Eurocode.

(6) DTIME Parameter for User Supplied Material Subroutine

```
!*****************************************************************************
!       USER SUPPLIED MATERIAL SUBROUTINE
!*****************************************************************************
        SUBROUTINE USRMAT(EPS0, DEPS, EPSP, NS, INFM_STEP, COORD, SE, USRVAL, NUV,     &
                          USRSTA, NUS, IUSRIND, NUI, SIG, STIFF,ID, DETJ)
         IMPLICIT NONE

        !DEC$ ATTRIBUTES DLLEXPORT::USRMAT

        INTEGER, INTENT(IN)      :: NS               ! NUMBER OF STRESS COMPONENT
        INTEGER, INTENT(IN)      :: INFM_STEP(5)     ! STEP INFORMATION FOR STAGE, INCREMENT,
ITERATION, ELEMENT, INTEGRATION POINT
       ! INFM_STEP(1) : STAGE ID
       ! INFM_STEP(2) : LOAD INCREMENTAL STEP ID
       ! INFM_STEP(3) : ITERATION STEP ID
       ! INFM_STEP(4) : ELEMENT ID
       ! INFM_STEP(5) : INTEGRATION POINT ID
        INTEGER, INTENT(IN)      :: ID               ! MATERIAL ID OF CURRENT ELEMENT
        INTEGER, INTENT(IN)      :: NUV              ! NUMBER OF PARAMETERS
        INTEGER, INTENT(IN)      :: NUS              ! NUMBER OF INTERNAL STATE VARIABLES
        INTEGER, INTENT(IN)      :: NUI              ! NUMBER OF INTEGER INDICATOR VARIABLES
        REAL*8,  INTENT(IN)      :: DETJ             !    DETERMINENT    VALUE    AT    CURRENT


       User Supplied Subroutine

        RETURN
END SUBROUTINE USRMAT
!*****************************************************************************
```

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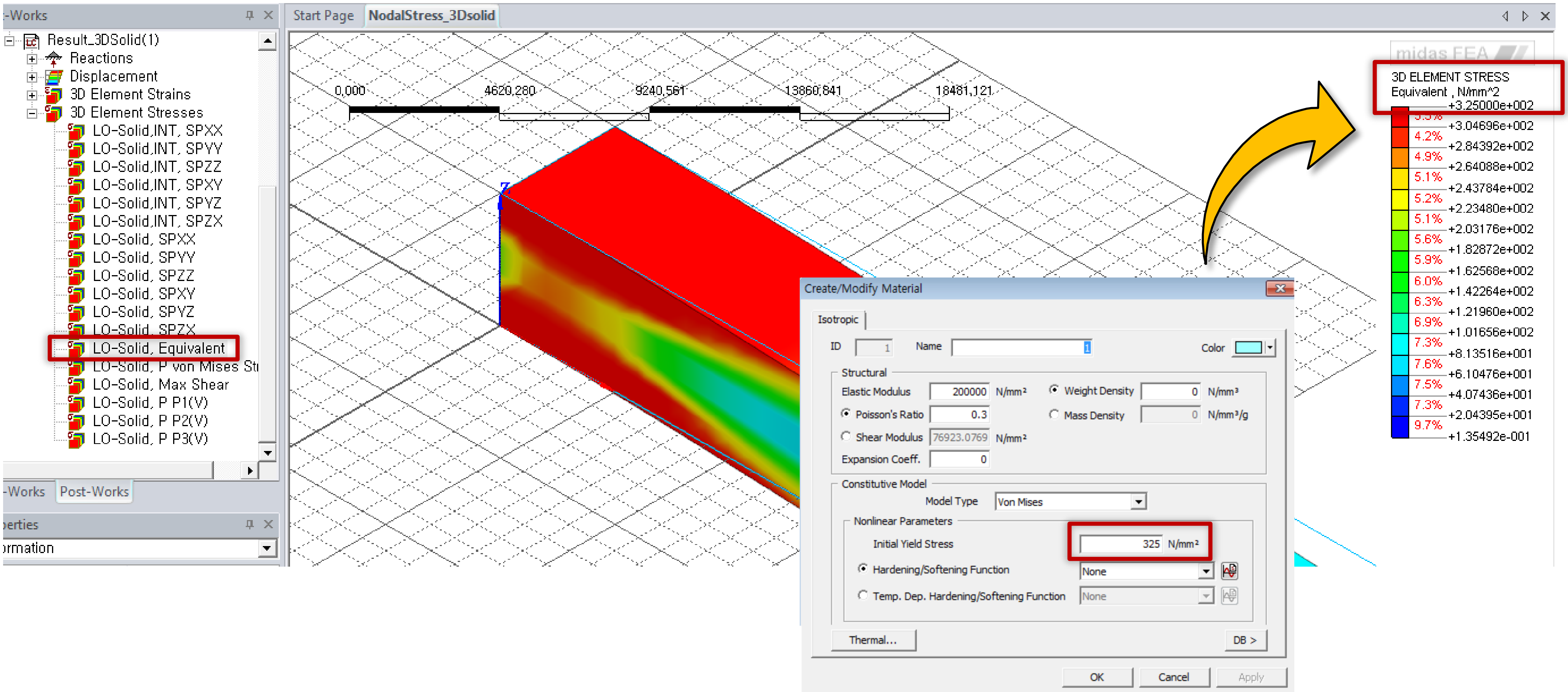
SUBROUTINE USRMAT (EPSO, DEPS, EPSP, NS, INFM_STEP, COORD, SE, USRVAL, NUV, USRSTA, NUS, IUSRIND, NUI, SIG, STIFFM, ID, DETJ, DTIME)

- SUBROUTINE USRMAT (EPSO, DEPS, EPSP, NS, INFM_STEP, COORD, SE, USRVAL, NUV, USRSTA, NUS, IUSRIND, NUI, SIG, STIFFM, ID, DETJ, DTIME), **DTIME: Total Time Increment**

Upgrade Contents

- The user can program the material which is dependent on time, e.g. visco-elastic model.

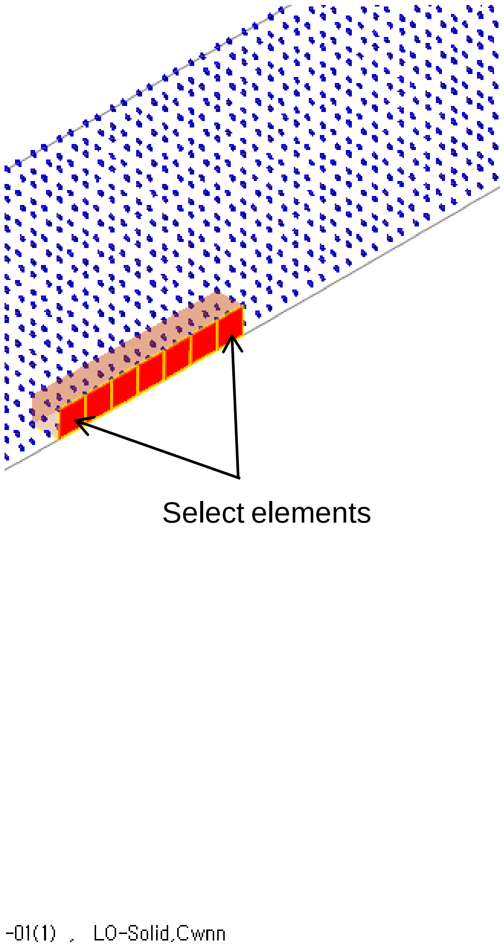
(1) Improvement about the von-Mises Stresses at Nodes

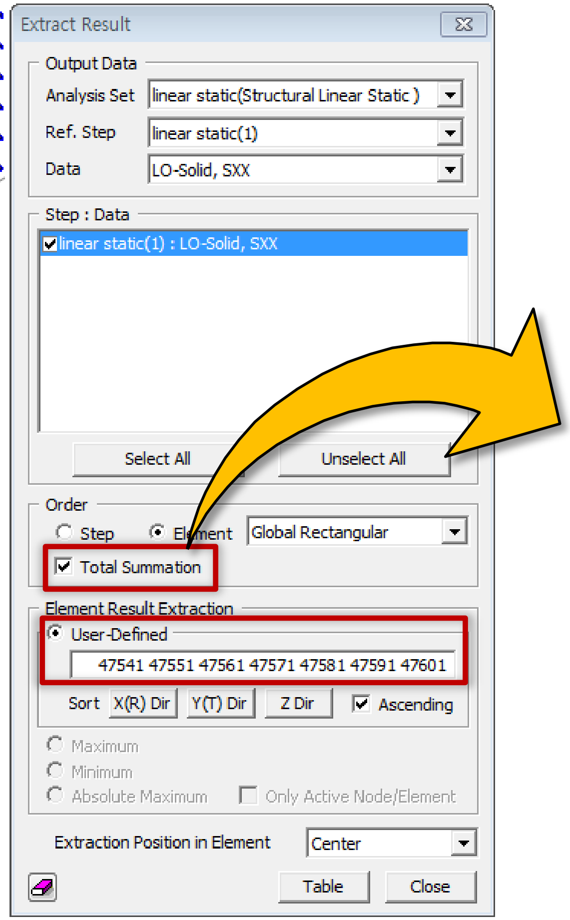


Upgrade Contents

- von-Mises stresses including Tresca and Rankine cannot exceed yield stress at nodal points as well as integration points.

(2) Summation of Crack Widths of Group of Elements





	No	Element	X	Y	Z	linear static(1) : LO-Solid, SXX
▶	1	47541	19.000000	-509.000000	1.000000	0.000032
	2	47551	19.000000	-511.000000	1.000000	0.000032
	3	47561	19.000000	-513.000000	1.000000	0.000032
	4	47571	19.000000	-515.000000	1.000000	0.000032
	5	47581	19.000000	-517.000000	1.000000	0.000032
	6	47591	19.000000	-519.000000	1.000000	0.000032
	7	47601	19.000000	-521.000000	1.000000	0.000032
	8	Total Summation				0.000221

Upgrade Contents

- In the total strain crack model, the crack with of single element depends on the element size. Summation of crack widths of group of elements is provided so that the crack with within certain distance can be checked regardless of mesh size.

(1) Convergence Error with Combined Cracking-Shearing-Crushing model

Problem

Convergence error in nonlinear analysis of interface elements with the 'Combined Cracking-Shearing-Crushing' material model.

Related Functions

- Analysis> Material > Interface

Correction

Improvement of convergence algorithm of CCSC material model.

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(2) Incorrect Self Weight of Pyramid Element

Problem

Incorrect total weight with the model consisting of pyramid elements.

Related Functions

- *.OUT Files

Correction

Corrected.

(3) Convergence Error in Nonlinear Analysis with Plate Offset

Problem

Convergence error in nonlinear analysis with plate offset.

Related Functions

- Analysis > Property > Plate

Correction

Improved.