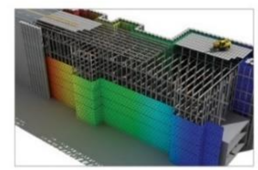
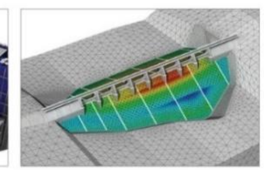
Release Notes

Release Date: November, 2017

Product Ver.: GTSNX 2018(v1.1)

GTS NX
Geo-Technical analysis System New eXperience

Integrated Solver Optimized for the next generation 64-bit platform

Finite Element Solutions for Geotechnical Engineering

MIDAS

Enhancements

1. Analysis

1.1 Improvement in Convergence Rate

(Enhanced Initial Stress & Over-Relaxation)

1.2 Material Tension Cut-off for Mohr-Coulomb model

1.3 Nonlinear Time History – Auto Self-Weight

2. Post Processing

2.1 Deformed and Un-deformed Shape display options

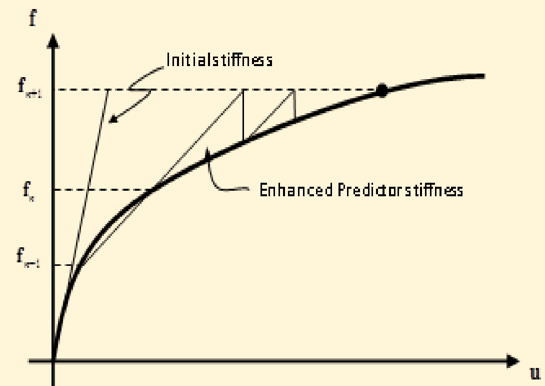
1. Analysis

1.1 Improvement in Convergence Rate (Enhanced Initial Stress & Over-Relaxation)

- The initial displacement estimation method is a method of predicting the initial displacement at the present stage using the load factor ratio taken from the present stage divided by previous stage and multiplied by the displacement result of the previous stage as shown in the following equation:

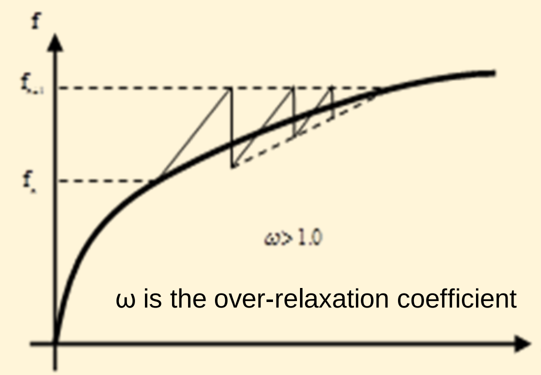
$$\Delta \mathbf{u}_n^{predictor} = \frac{\Delta \mu_n}{\Delta \mu_{n-1}} \Delta \mathbf{u}_{n-1}$$

- The estimated displacements do not exactly coincide with those of the current step, but they are useful for iterative calculations because they predict closer results than the displacements estimated by elastic stiffness. Particularly, it is more effective when the material model has a large plasticity.
- However, because it is less accurate than the estimated tangent stiffness by Newton-Raphson, it is recommended to use it with the initial stiffness method. In general, the initial stiffness method is a stable method for solving the problem.



Estimation of Initial Deformation (enhanced predictor)

- The over-relaxation method is one of the methods to improve the convergence rate by multiplying the estimated unbalance force by the coefficient at the iterative calculation.
- Although it is a basic approach rather than a line search method, it is a method that is very similar to the initial stiffness method because the formula is very simple and unlike the line search method, the additional analysis time is required in the iterative calculation.
- The initial relaxation coefficient is directly input by the user, 1.2 is defined as the default value, and should not exceed 2.0 at maximum.



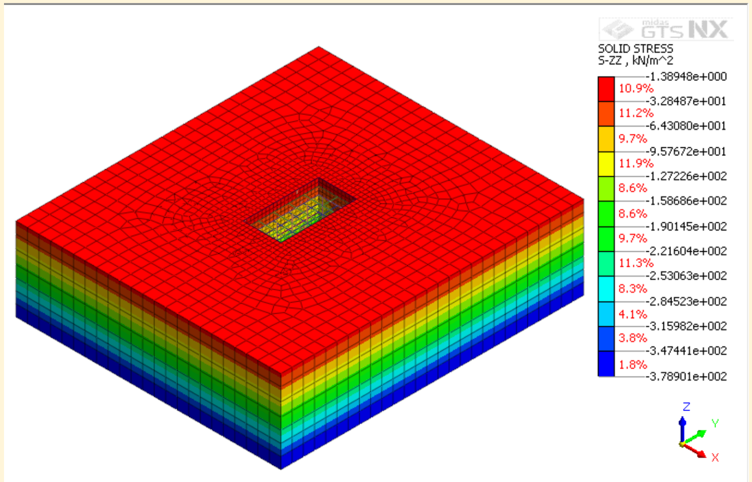
ω is the over-relaxation coefficient

Over-relaxation method

1. Analysis

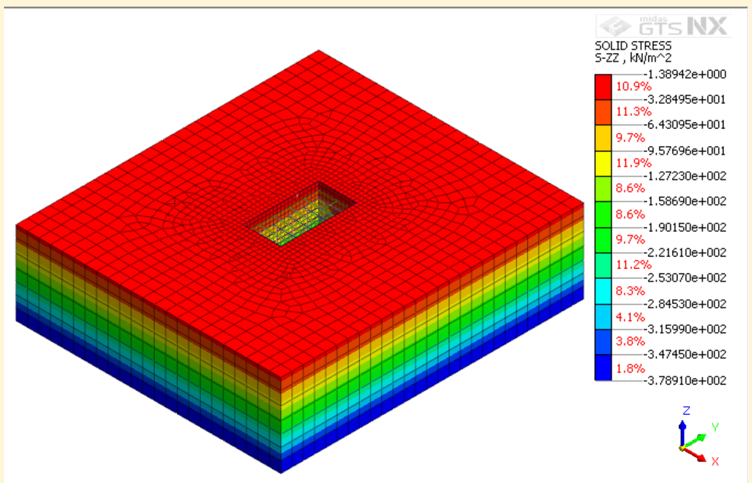
1.1 Improvement in Convergence Rate (Enhanced Initial Stress & Over-Relaxation)

- Differences in calculation speed are visible even for relatively small sized models.




```
> STIFFNESS UPDATES     :    7
> LOAD BISECTIONS      :    0
> LINE SEARCHES       :    0
>
> ANALYSIS WALL CLOCK TIME : 28.737 sec
> ANALYSIS COMPLETED
>
> [SYSTEM INFO]
> NUMBER OF THREADS     : 3
> MAXIMUM MEMORY USAGE : 1304 MB
> AVAILABLE MEMORY      : 12347 MB
> TOTAL CPU TIME        : 635.969 sec
> WALL CLOCK TIME       : 281.112 sec
> TOTAL WARNINGS : 0
>
```

Excavation Problem: Default Iterative Scheme

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> STIFFNESS UPDATES     :    1
> LOAD BISECTIONS      :    0
> LINE SEARCHES       :    0
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> ANALYSIS WALL CLOCK TIME : 50.914 sec
> ANALYSIS COMPLETED
>
> [SYSTEM INFO]
> NUMBER OF THREADS     : 3
> MAXIMUM MEMORY USAGE : 1123 MB
> AVAILABLE MEMORY      : 12561 MB
> TOTAL CPU TIME        : 552.118 sec
> WALL CLOCK TIME       : 200.297 sec
> TOTAL WARNINGS : 0
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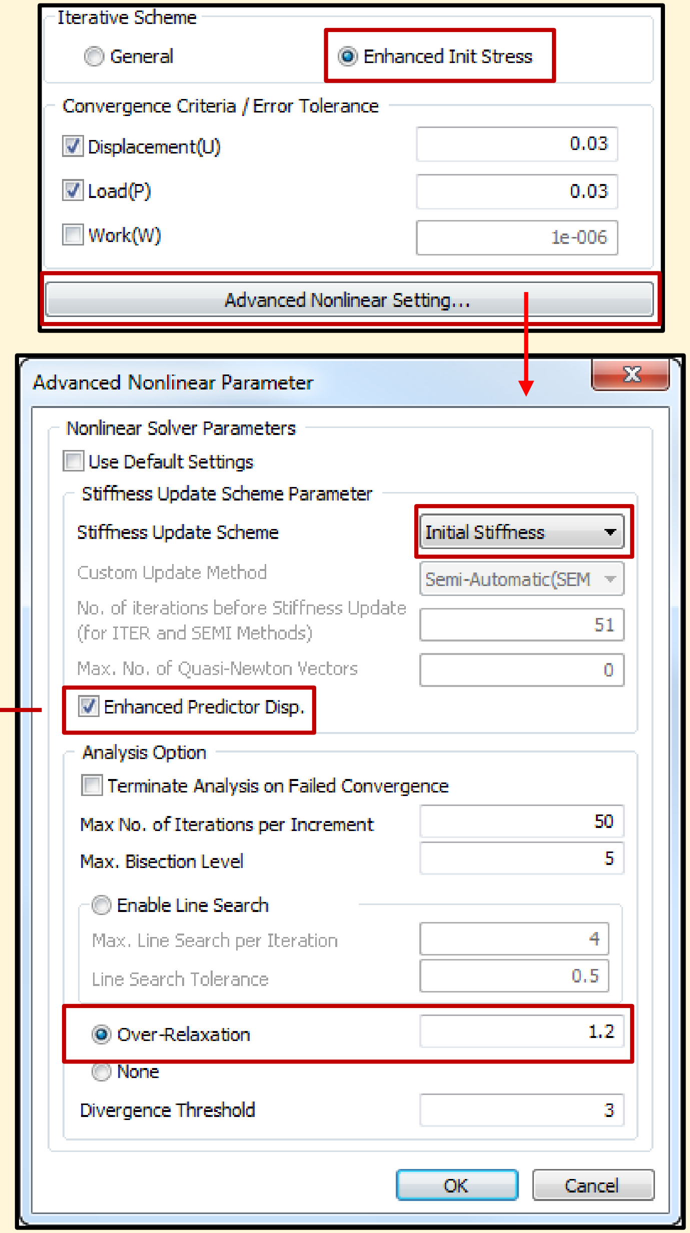
Excavation Problem: Enhanced Initial Stress Iterative Scheme



1. Analysis

1.2 Material Tension Cut-Off for Mohr-Coulomb model

- Soil can only resist against a limited amount of tension in any direction. Therefore, a tension cut-off option is introduced to avoid the unrealistic tension being generated in the soil during analysis.
- In order to do that, Mohr-Coulomb material Tension Cut-off for Rankine type has been added.
  In the Mohr-Coulomb model tensile strength can be considered based on two types: Pressure and Rankine.
- In the first “pressure type” method, the average of the principal stresses cannot exceed the tensile strength:

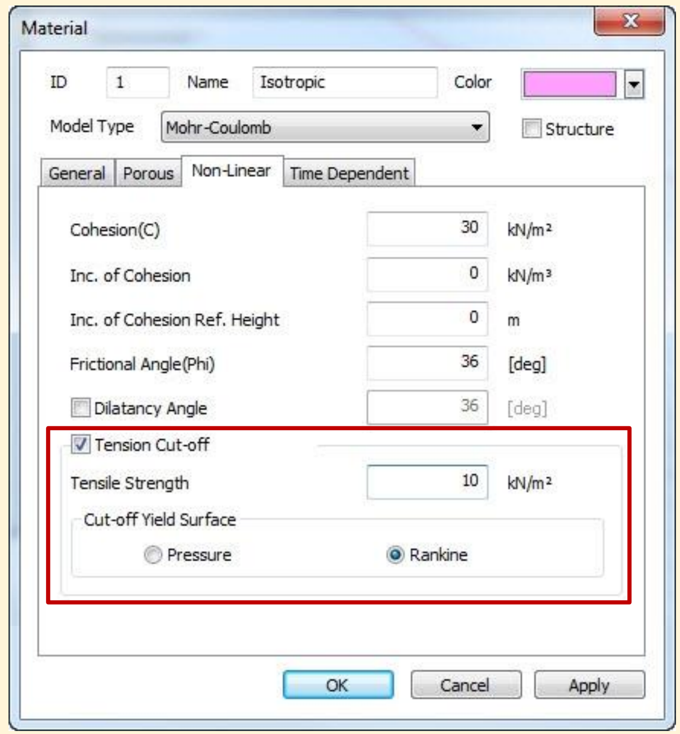
$$\frac{\sigma_1 + \sigma_2 + \sigma_3}{3} < \sigma_t$$

Pressure Type

- For Rankine type the maximum principal stress should not exceed the tensile strength.

$$\sigma_1 < \sigma_t$$

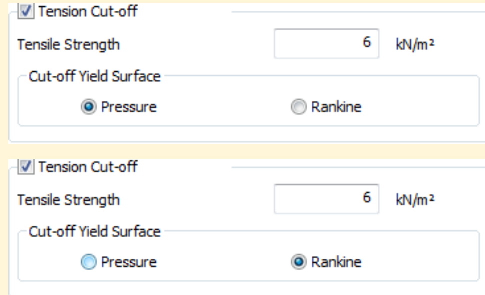
Rankine Type



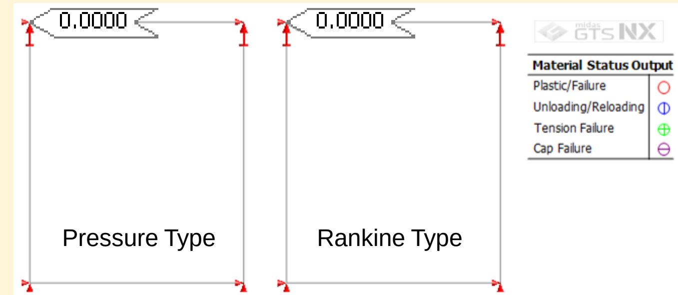
1. Analysis

1.2 Material Tension Cut-Off for Mohr-Coulomb model

- Simple example: Plate under Tension
- Material Parameters are the same except of Non-Linear settings.
- Dimensions are the same.
- Loads and BC are the same for both models.

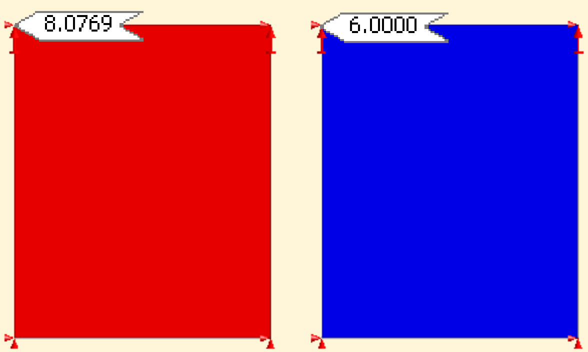


Tension Cut-Off limits

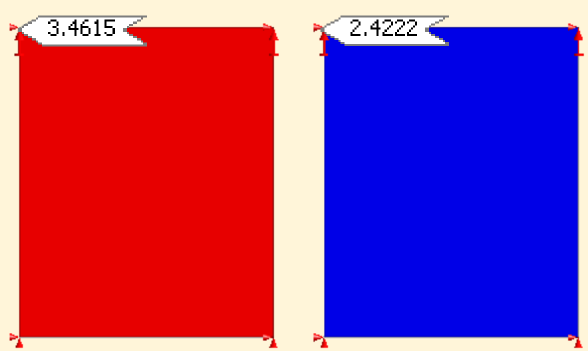


Nonlinear solution at 50% of applied tensile load:
No Plastic failure

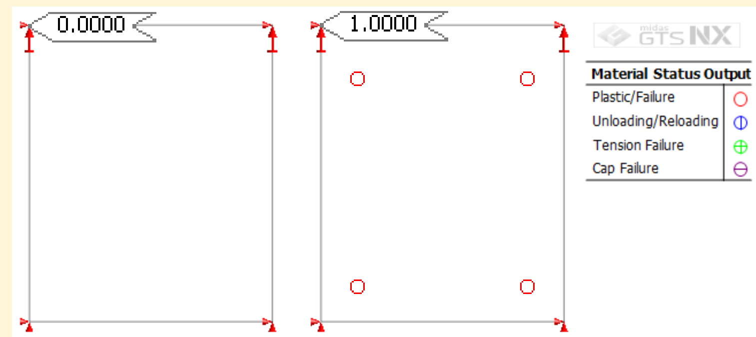
Nonlinear solution at 60% of applied tensile load



σ_1 stress result

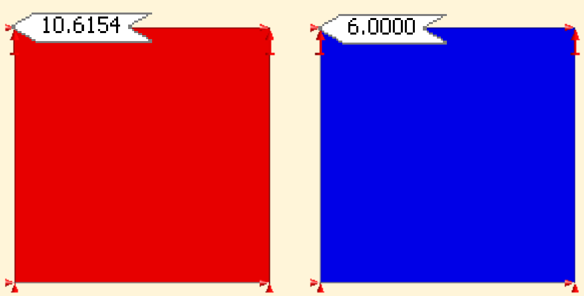


σ_2, σ_3 stress result

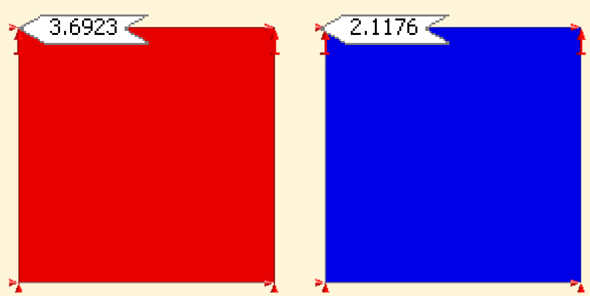


Failure has been achieved for Rankine type only.

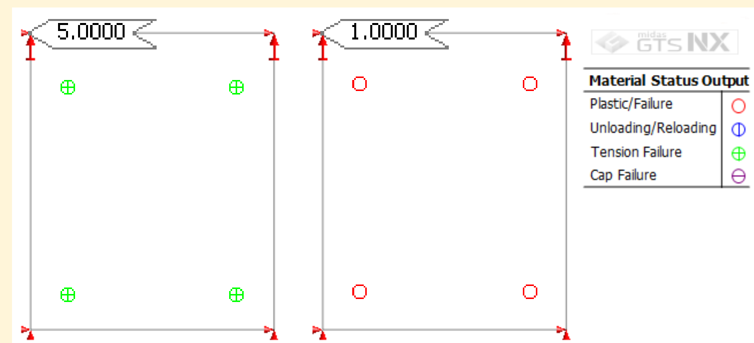
Nonlinear solution at 70% of applied tensile load



σ_1 stress result



σ_2, σ_3 stress result

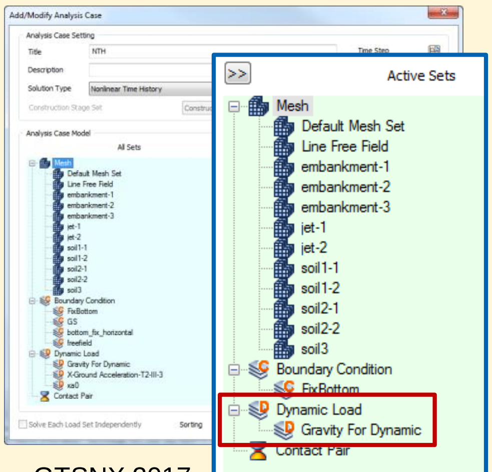


Failure has been achieved according to both criterions.

1. Analysis

1.3 Nonlinear Time History – Auto Self-Weight

- Self-weight is automatically considered when option check is selected.
- In previous versions activation of time dependent Static Gravity load was required for Self Weight consideration in addition to Include In-Situ Analysis with Self Weight option.



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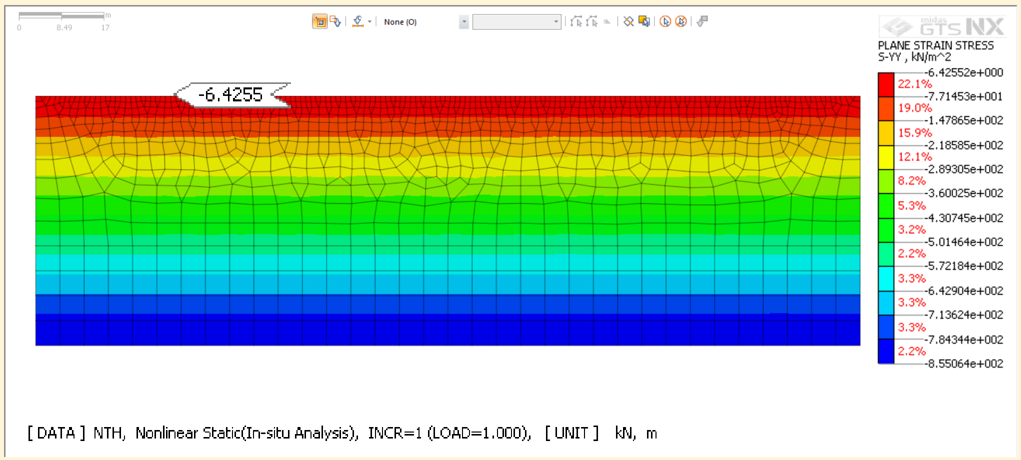
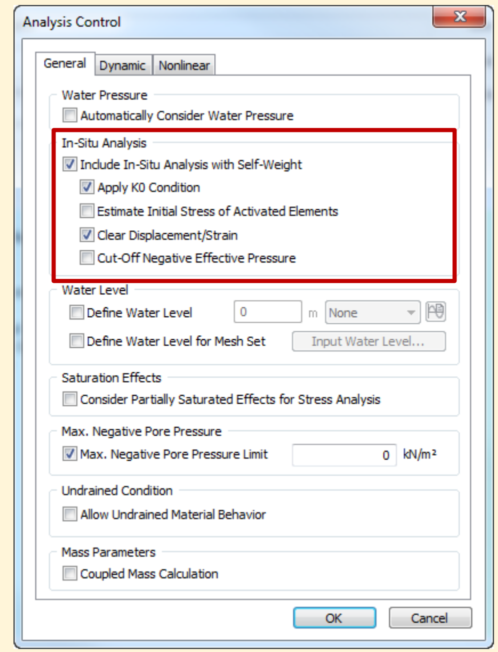
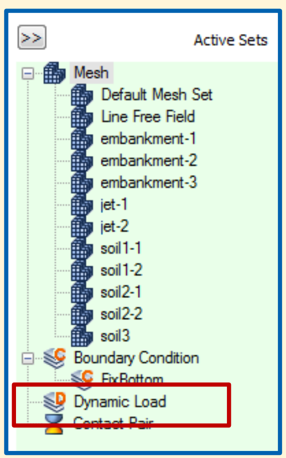
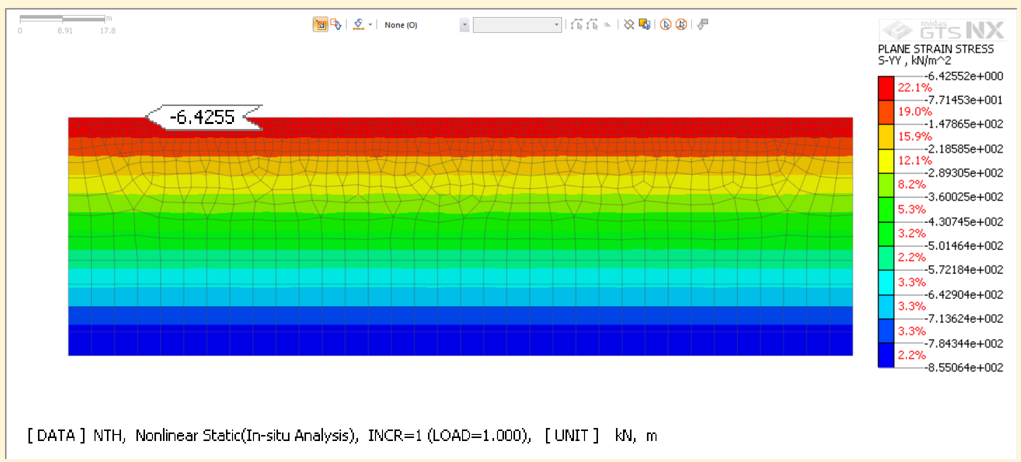




After checking, activation of “Gravity” load is not required.





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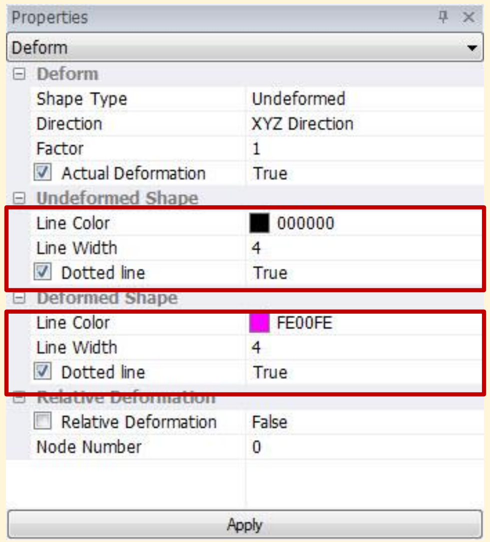
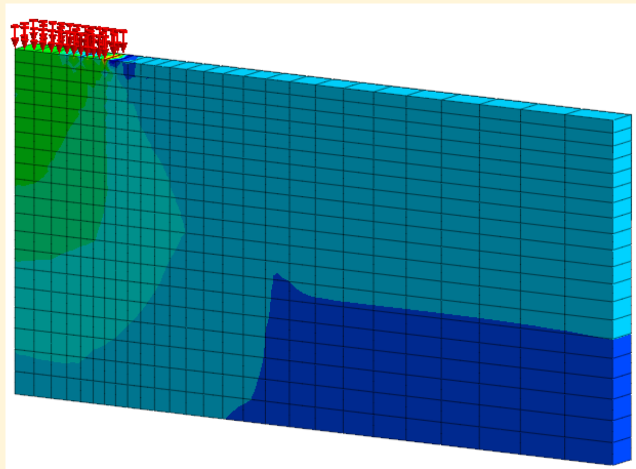
2. Post Processing

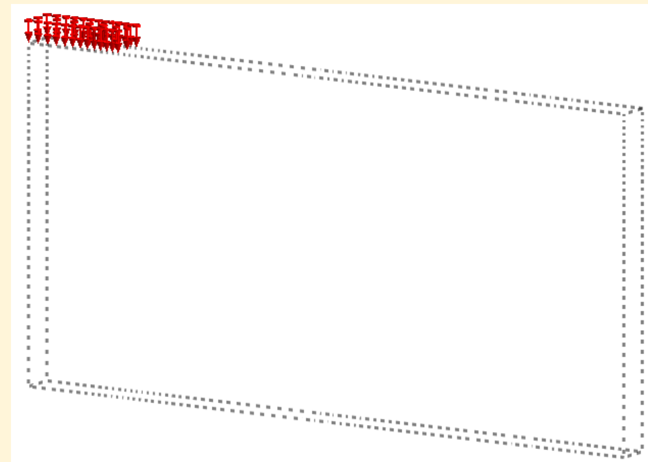
2.1 Deformed and Undeformed Shape display options

- Undeformed Shape and Deformed Shape can be visually shown via Dotted lines with additional options like Width and Color.

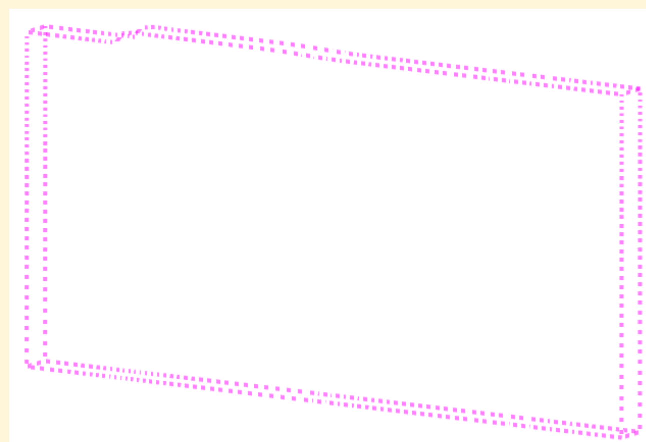




Initially displayed shape



Undeformed “dotted” shape



Deformed “dotted” shape