

Release Note

Release Date: January 2023

Product Version: GTS NX 2023(v340)







Integrated Solver Optimized for the next generation 64-bit platform Finite Element Solutions for Geotechnical Engineering



Enhancements

1. Pre/Post Processing

- 1.1 Analysis Restart Option Improvement For Consolidation /NLS/Fully Coupled Stress Seepage Analysis Types
- **1.2** Automatic Merging Of Nodes When Deleting Interface Elements
- **1.3 On-curve Diagram Function Extension**
- 1.4 LDF Functionality Extended
- 1.5 Dynamic Poisson's Ratio
- 1.6 Rayleigh Damping Output For Each Mode Of Eigenvalue Analysis
- 1.7 Point Spring–Damping Ratio
- **1.8 Surface Spring Function**
- 1.9 Design Spectrum
- 1.10 Show/Hide All Water Levels

- 1.11 Cut-off Negative Effective Pressure
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Enhancements

2. Analysis

- 2.1 Complaint Base Boundary Function
- **2.2 Free-field Ground Damper Function**
- 2.3 User-supplied Soil Material Features
- 2.4 Incorporated Soilworks LEM Features
- 2.5 Safety Factor Graph In SRM Execution
- 2.6 Boundary Condition For (SRM) Slope Stability During Stress-nonlinear Time History
- 2.7 Concrete Smeared Crack Model
- 2.8 Concrete Damaged Plasticity Model
- 2.9 Fatigue Analysis



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1.1 Analysis Restart Option Improvement

In the previous version, we were able to restart the analysis from a specific stage. From the 2023v1.1 version, we can able to Restart the Analysis from the last converged step of a particular stage. This function is applicable to Nonlinear Static(NLS)/Consolidation/Fully Coupled Stress Seepage/Construction Stage analysis types

Save Last Converged Step: Saves All Stages and Last Converged Step.

•	Analysis > Anal	ysis Case >	General >	Solution	Type : Construction	Stage> And	alysis Control
---	-----------------	-------------	-----------	----------	---------------------	------------	----------------

eneral Nonlinear Age	
Water Pressure	
Automatically Consider Water Press	sure
Initial Stage	
Initial Stage for Stress Analysis	
Apply K0 Condition	
Cut-Off Negative Effective Pres	sure
Initial Stress	
Estimate Initial Stress of Activated	Elements
	Lienicitts
Final Calculation Stage	
End Stage Middle Stage	~
Specify Restart Stage	~
Restart Option	
Save only User Specified Stages	
O Save All Stages	
Initial Temperature	
Initial Temperature By Value	0 [T]
	Internet in the second second

Construction Stage 2021v1.1

Ilysis Control X	Analysis Control	
Seneral Nonlinear Age	General Nonlinear Age	
Water Pressure	- Water Pressure	
Automatically Consider Water Pressure	Automatically Consider Water Pressure	
Initial Stage	Initial Stage	
Initial Stage for Stress Analysis	Initial Stage for Stress Analysis 1:Construction	on Stage 😔
Apply K0 Condition	Apply K0 Condition	
Cut-Off Negative Effective Pressure	Cut-Off Negative Effective Pressure 1:Construction	on Stage \vee
	Initial Stress	
Initial Stress	Estimate Initial Stress of Activated Elements	
	First Cale Jakas Stars	
Final Calculation Stage		an 1
End Stage OMiddle Stage	End Stage O'Middle Stage I:Construct	on Stage \vee
	Specify Restart Stage 2:2	~
Specify Restart Stage	Restart Option 1:Construction Sta 2:2	ge-1_LCS
Restart Option	O Save only User Specified Stages 2:2_LCS	
	O Save All Stages	
Save All Stages	Save All Stages and Last Converged Step	
Save All Stages and Last Converged Step	Initial Temperature	
Initial Temperature	Initial Temperature By Value	0 [T]
Initial Temperature By Value 0 [T]	Initial Temperature By Load Set None	8
Initial Temperature By Load Set None		

Construction Stage 2023v1.1

Restart Analysis Step Selection

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1.2 Automatic Merging Of Nodes When Deleting Interface Elements

• When an interface element is created, it automatically creates two separate nodes at each nodes on the interface. In the previous version, even if the interface was deleted, the separated nodes were maintained, so the user had to merge the separated nodes manually. For the convenience of the user, the function has been changed to automatically merge the separated nodes when the interface element is deleted.







1.3 On-curve Diagram Function Extension

- The function type of the On-Curve Diagram has been extended to Cutting-Plane Diagram. The contour of the shell element (for instance) can be easily understood in Graphical/diagram form.
- Result > Advanced > Cutting Diag. > Cutting Plane/Element

Name	Diagram-1	
Cutting	Diagram Mode	
OCu	tting Line	ne/Element
0.6		
Define F	ositions	
Туре	2D Elem	~
	3 Points Plane Select Plane	
	2D Elem	
)irection	Solid-Face	
Revers	ie -	
	OK Cancol	Apply
0.5	116 20.001	Anniv



1.4 LDF

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• A LDF defined in one stage can be copied to any number of construction stages in the model. For instance, in the case of defining the Relaxation of the tunnel, this improvement will be helpful to reduce the time taken for defining the LDF in every single stage.



1.5 Dynamic Poisson's Ratio

• Dynamic Poisson's ratio is included for the Ramberg-Osgood, Hardin-Drnevich, and GHE-S material models.

Material X	Material X	Material
ID 2 Name Isotropic Color	ID 2 Name Isotropic Color	ID 2 Name Isotropic Color
Model Type Ramberg-Osgood(MODS) V Structure	Model Type Hardin-Drnevich(MODS) V Structure	Model Type GHE-S(MODS) V Stru
General Porous Non-Linear Thermal	General Porous Non-Linear Thermal	General Porous Non-Linear
Non-Linear	Non-Linear	Initial Shear Modulus
Initial Shear Modulus kN/m²	Initial Shear Modulus 🛛 🚺 kN/m²	Peference Chain
Reference Strain 0	Reference Strain 0	
Maximum Damping 0	Poisson's Ratio(For Dynamic) 0.3	
Poisson's Ratio(For Dynamic) 0.3	Consider Shear Stress Only	
	Constraint pressure dependence	C1(∞) 0
Constraint pressure dependence	n1 0.5	C2(0) 0
n1 0	0.5	C2(∞) 0
D2 0		alpha 0
	Update Young's Modulus	beta 0
Update Young's Modulus		Consider Shear Stress Only
		Update Young's Modulus
		Damping Function
		Hmax 0
		beta1 0
		Large Strain
		Minimum Strain 0
		Maximum Strain 0
		Unloading Stiffness
		Gmin/Gref 0
		Unloading Reference Strain 0
		n1 0
		n2 0
		Material Evaluation



1.6 Rayleigh Damping Output For Each Mode Of Eigenvalue Analysis

- Eigenvalue analysis provides Rayleigh damping ratios for each mode based on the strain energy of the structure.
- This can be used to obtain modal damping ratios in the structure with different materials or damping devices.
- Analysis > Analysis Case > General > Solution Type: Eigenvalue > Analysis Control
- Result > Advanced > Others > Modal Damping Ratio

Initial Temperature			
Initial Temperature By Value			0 [T]
Water Level			
Define Water Level	Ę.	m None	~ 19
Define Water Level for Mesh	Set	Input Wate	er Level
Eigenvectors			
✓ Number of Modes			10 🚔
Frequency Range of Interest			
Lowest 0	Hig	hest	0
		Unit: [C	ycle]/ sec
Sturm Sequence Check			
Saturation Effects			
Consider Partially Saturated Ef	ffects for	Stress Analys	is
Max. Negative Pore Pressure			
Max. Negative Pore Pressure L	Limit [0 kN/m²
Undrained Condition			
Allow Undrained Material Beha	vior		
Mass Parameters			
Coupled Mass Calculation			
Modal Damping Ratio			
Calculate Strain Energy Propor	tional Dar	nping Ratio	



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1.7 Point Spring – Damping Ratio

- Incorporated damping ratio to point spring, matrix spring, and elastic link and added to all types of elements like linear elastic, nonlinear elastic, tension only, compression only, hook, gap, free ground damper, etc.,
- Since material damping input is not present for these elements, the developed damping ratio will be used in the calculation of Rayleigh damping mentioned in section 1.6 of this release notes.

Create/Modify Other Property	Х			Create/Modify Other Property	×
ID 1 Name	e Other Property Color			Point Spring Matrix Spring	ID 1 Name Other Property Color
Matrix Spring Image: Constraint of the synthesis of the synthesynthesis of the synthesynthesis of the synthesis of the synthesis o	Linear Elastic Linear Elastic Linear Elastic Tension Only Compression Only Hook Gap Nonlinear Elastic Free Ground Damper Ky 0 KNrm/[rad] Krz 0 KNrm/[rad] Krz 0 KNrm/[rad] Krz 0 KNrm/[rad] Krz 0 KN*sec/m Cy 0 KN*sec/m Crx 0 KN*msec/[rad] Cry 0 KN*msec/[rad]			Matrix Spring Reflect the Right Link Interface Shell Interface User Supplied Behavior for Shell Interface Pile Tip Infinite Free Field Seepage Cut Off	Type Tension Only Vinear Elastic Ringe Property Fension Only Vinear Elastic X-Direction Spring Constant(Kx) Compression Only Nonlinear Elastic Y-Direction Spring Constant(Kx) 0 kW/m Z-Direction Spring Constant(Kx) 0 kW/m Y-Direction Spring Constant(Kry) 0 kW/m Y-Direction Spring Constant(Kry) 0 kW/m Y-Direction Spring Constant(Kry) 0 kW·m/[rad] Y-Direction Spring Constant(Krz) 0 kW·m/[rad] Z-Direction Spring Constant(Krz) 0 kW·m/[rad] Desepage flow 0 m²/sec Thermal 0 m²/sec Damping 0 0
		Create/Modify Other Property	×		OK Cancel Apply
	OK Cancel Apply	Point Spring Matrix Spring	ID 2 Name Other Property Color		Circei pappy
		Elastic Link Rigid Link Interface Shell Interface User Supplied Behavior for Shell Interface Pile Tip Infinite Free Field Seepage Cut Off	Kx Ky Kz Krx Kry Krz Kx 0 0 0 0 0 Ky 0 0 0 0 0 Kz 0 0 0 0 0 Kz 0 0 0 0 0 Krx 0 0 0 0 0 Kry 0 0 0 0 0 Krz 0 0 0 0 0 Damping 0 0 0 0		

1.8 Surface Spring Function

• The stiffness of the soil varies with depth. To define the varying stiffness with respect to space using the surface spring function of GTS NX, a 'Base Function' is introduced in the new version.

Surface Spring	Surface Spring	Surface Spring ~	Surface Spring \checkmark
		Target Object	Target Object
larget Object	larget Object	Targe Frame 🗸	Targe Frame ~
Targe Frame ~	Targe Frame V	Select Object(s)	Select Object(s)
Select Object(s)	Select Object(s)	Element Width 1 m	Element Width 1 m
Element Width 1 m	Element Width 1 m	Convertion	
Convert to	Convert to	Point Spring	O Point Spring
Point Spring	O Point Spring	C Elastic Link	Elastic Link
C Elastic Link	Elastic Link	O Normal/Shear Elastic Link	Normal/Shear Elastic Link
Normal/Shear Elastic Link	O Normal/Shear Elastic Link	Point Spring Information	Elastic Liek Tefermation
		Modulus of Subgrade Reaction	Boundary Condition Set
Point Spring Information	Elastic Link Information		Boundary Set-1
Modulus of Subgrade Reaction	Boundary Condition Set	Base None V	
Kx 0 kN/m³	Boundary Set-1	KX <u>0</u> RV/m ³	Direction Normal(+) ~
Ky 0 kN/m³	Direction Namel(1)	Base None 🗸 🍋	Modulus of Subgrade Reaction
	Normal(+)	Ky 0 kN/m ³	Des Dansfers Mars and KB
	Modulus of Subgrade Reaction	Base None V	
Damping Constant/Area	0 kN/m³	Kz 0 kN/m3	0 kN/m³
Cx 0 kN·sec/m³	Length of Electic Link		l enoth of Elastic Link
Cy 0 kN·sec/m³		Damping Constant/Area	
Cr. D khimee (m3	0 m	Cx 0 kN-sec/m³	0 m
C2 NV SEL/III	Tens, Only Comp. Only	Cy 0 kN-sec/m³	Tens. Only Comp. Only
		Cz 0 kN·sec/m³	Damping
		Densities	Damping Batio
		Damping Damping Damping 0	
			3
Property	Property	Property	Property
1		3 3: Surface Spring	3 3: Surface Spring V
sh Set Surface Spring 🗸	Mesh Set Surface Spring ~	Mesh Set Surface Spring ~	Mesh Set Surface Spring ~



1.9 Design Spectrum For Seismic Analysis

• Latest international design spectrum functions are added.

Dynamic Analysis > Load > Response Spectrum

		Taiwan(202	2)	 Nor 	malize	ed Acc	el (elerat	tion	C) Velo	city		C) Disp	lacem	ient
	Design Spe	ectrum		Scaling	e Fact	or		1			Damp	ing R	atio	05	Grap	h Opti	on S	cale
2	Period (sec)	Spectral Data	^		. Value	e [0 g					0.		□× □Y-	axis L	.og So	cale
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	0.12	0.2551		0.24 -			_									_		_
	0.2	0.2551		0.22													_	_
	0.3	0.2551		0.2	1													_
	0.36	0.2551		0.18 - 0.17 -	1						8.3							_
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KDS(41-17-00:2019)	~
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KBC(2009)	
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Korea(Arch. 2000)	_
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UBC(1997)	
UBC 88-94	
NBC(1995)	
Eurocode-8(2004)	
Eurocode-8(1996) Design	
Eurocode-8(1996) Elastic	
China(GB/T 51408-2021)	
China(JTG/T 2231-01-2020)	
China(GB50011-2019)	
China(CJJ 166-2011)	
China(GB50011-2010)	-
China(GB50111-2006)	
China(GB50011-2001)	
China Shanghai (DGJ08-9-2003)	
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1.10 Show/Hide All Water Level Option

It was needed to hide/show all the water levels defined in each stage individually in the previous versions. Now in the latest version, you can be able to hide/show the water levels of all the stages with one click.



1.11 Cut-off Negative Effective Pressure

In the latest version, the user will have the flexibility to choose a stage to cut-off negative effective pressure. The previous version only allowed the user to cut off the negative effective pressure only for the initial stage of stress analysis.

's > Analysis Case > General > Solution Type : Construction Stage > Analysis Con	trol
	Initial Stage
Initial Stage	Initial Stage for Stress Analysis 1:Construction Stage-
✓ Initial Stage for Stress Analysis 1:Insitu ∨	Apply K0 Condition
Apply K0 Condition	Cut-Off Negative Effective Pressure 1:Construction Stage- ~
Cut-Off Negative Effective Pressure	1:Construction Stage-1 2:Construction Stage-2
	3:Construction Stage-3
	Estimate Initial Stress of Activated Elements
	2023v1 1
2021v1.1	



1.12 Exact Method To Calculate Von Mises Stress And Principal Stress For The Nodal Average Calculation

Since the stress components are directional, we added a method of calculating the average value when considering the Von Mises and Principal Stress results.

- Simple Average: Simple average of each element result that share a node.
- **Exact:** After simple averaging of the stress components (XX, YY, XY, etc.) of each element that shares nodes, the principal stress and von Mises stress are recal culated.
- By default Simple Average Option is used in the latest version. The user has the option to change the method.
 - Analysis > Tools > Option



1.13 Exact Method And Simple Average Method In Results Combination

In the latest version, the user will have the option to choose between the Exact and Simple Average methods while linearly combining the results.

Result > Result > Combination

Simple Add



1.14 Element Contour Plot

If the results of two different elements are seen using an element contour plot function, the results are calculated as follows,

Nodal Average Option: Simple Average

Calculate as simply average at nodes that share element results. Simply averaging the result items selected by the user

Nodal Average Option: Exact

Basic stress by element type(XX, YY, ZZ, XY ...) is a simple average. Principal stress, von Mises, etc. are calculated using the Exact method at nodes shared by different elements.

Average of exact-calculated results

However, if you use the modeled state without sharing nodes, that is, contact, etc., it is calculated by element type.



1.15 Scale Factor For Functions

• When a base function is defined, but the value is inputted as 0, we may find abnormal behavior in the model. Hence, a warning message is developed, and it can be seen when a zero value of the forces/pressure is inputted.

Force Moment			
Name Force-1	Har .		
Object			
Type Node	~		
Select Object	t(s)		
Load Type			
Total Force OPe	er Face/Edge		
Reference Object			
Type Coordinate	~		
Ref. CSys Global Rectang	gular 🗸 长		
Components			
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x	0 kN		
		> GTS NX 2023 (v1.1) (64bit)	nation Technology Co. 1td All RIGHTS RESERV
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Z	0 kN	[Error] Force value cannot be zero! [Error] Force value cannot be zero!	
		 Work project is being saved by auto-savel [Fror] Force value cannot be zero] 	ve function.
ter			



Result > Advanced > Extract

1.16 More Result Extraction Positions For Beam Elements

• Previously, in the case of beam elements, only the results for the I and J stages could be extracted, but more result extraction locations has been added so that the results can be extracted according to the [number of output segments of beam elements] set in Analysis Case > Result Control.

Output Type Output Op	otion		
Write Results of All	Active Mesh Sets		
Nodal Results		Element Results	
Displacement	Mesh Set	Force	Mesh Set
Applied Load	Mesh Set	Stress	Mesh Set
Reaction Force	Mesh Set	Strain	Mesh Set
Grid Point Force	Mesh Set	Status	Mesh Set
Contact	Mesh Set	Ductility	Mesh Set
(Contrary)	, bind y and rexe	Shell Mid-Plane R	Results
		Number of Beam Out	tput Segments 4

Tact Results			0
Output Data			
Analysis Set	K0_0.5		~
Result Type	Beam Ele	ment Forces	~
Results	All		~
Step: Results			
Crown sup Harden cro Invert exc Invert sup Harden inv	port:INCR own suppor avation:IN port:INCR /ert suppor	=1 (LOAD=1.0 t:INCR=1 (LO CR=1 (LOAD= =1 (LOAD=1.0 t:INCR=1 (LO	000):Beam E AD=1.000): 1.000):Bear 000):Beam El AD=1.000):I
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Element Resu User Defin Select Object	lt Extractio ned t	n	1168
	Y	7	Ascending
Sort X			

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1.17 Prestress Copy Function When Copying 1D Mesh/Elements

• When you copy 1D elements to which prestress is defined, the prestress load can also be copied together.

- Mesh > Mesh Set > Copy
- Mesh > Transform > Translate / Rotate / Mirror

esh Set X	Mesh Move/Copy X	Mesh Move/Copy X	Mesh Move/Copy X
Rename Copy Create Divide	Translate Rotate Mirror Scale Sweep	Translate Rotate Mirror Scale Sweep	Translate Rotate Mirror Scale Sween
	Select Objet	Select Objet	Transate Rotate Factor Steele Sweep
Select Object(s)	Mesh Set Element Node	Mesh Set Clement Node	Select Objet
Mesh Set	Select Object(s)	Select Object(s)	Mesh Set O Element O Node
Name Mesh Set Copy	Direction	Rotation Axis	Select Object(s)
Add to Mesh ~	Select Direction	Select Rotation Axis	
			Mirror Type Plane V
Copy Prestress for 1D Elements			
	0, 0, 0		Select Plane
OK Cancel Apply	1, 1, 1	0,0,0	O 3 Points Plane
		1, 1, 1	0, 0, 0
Сору	Method	Mothed	0.0.0
	(Uniform) (Non-Uniform)		0,0,0
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	Distance 30 <	Angle 30 [Dec]	Copy Object
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		Times 1	✓ Copy Prestress for 1D Elements
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			Mesh Set Copied Mesh Set-1 ~
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	🐺 🔗 🛍 OK Cancel Apply >>	🔯 🔗 🛱 OK Cancel Apply >>	🚑 🛃 🛄 OK Cancel Apply >>
	Translate	Rotate	Rotate
	Inditistate	Hotale	Hotate



1.18 Consider Rotation For Embedded Truss

• Considered the rotation of embedded elements, If the embedded element is included in the shell, the option must be turned on.

Create/Modify 1D Property	×	Create/Modify 1D Property	×
Pile Geogrid(1D) Truss Embedded Truss Beam	Plot Only(1D) Embedded Beam	Pile Geogrid(1D) Plot Truss Embedded Truss Beam Em	Only(1D) bedded Beam
ID 1 Name 1D Property	Color 📃 🗸	ID 7 Name 1D Property Color	
Constitutive Behavior From Material	v	Constitutive Behavior From Material ~	
Material Cross Sectional Area(A)	✓ 1/E 0 m ²	Material 1: Isotropic Cross Sectional Area(A) 0	n ²
		Spacing 1 r	n
Spacing Section	1 m	□ Section Consider rotation of the embedding elements	
		OK) Cancel	Apply



1.19 Result Tag Font Size Adjustment

- You can adjust the text size of the result tag. Adjustment is possible in steps 1 to 5.
- Result > Advanced > Probe

Entity Type Node Element	Color Tag Co Text Co	lor	Value Exponential Decimal Point	Tag Type	
Results Show	Type Node	ID 130	Value 0.5640		





1.20 3D PDF Output Of Water Surface

• In the latest version, the users can export the Phreatic line/surface, cutting plane, and Isoplanes into a 3D PDF output.



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1.21 Result Output Options for Time History Analysis

• Added a tab labelled "Min/Max/Abs Max Result" in order to facilitate a more thorough comprehension of the output for the following analysis cases.



1.22 Separation Of Analysis Option From General Options

- General options and analysis options are separated. Previously, the analysis options were not saved in the model file despite the fact that the analysis results are depended on the analysis options.
- Now, the analysis options are saved in the individual model file.



1.23 Undrained Condition For Construction Stage Analysis

Main Analysis Control now has a tab for "Undrained Material Behavior." Using this option, we can overcome the hassle of activating the 'Allow Undrained Behavior' option in each construction stage. Analysis > Analysis Case > General > Solution Type: Construction Stage > Analysis Control

	Analysis > Analysis Case > Gel	eral > Solution Type: Construction	on Stage Analysis > Analysis Control
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eral Nonlinear Age	÷
Water Pressure	~
Automatically Consider Water Pressu	re
Initial Stage	
Initial Stage for Stress Analysis	1:INITIAL GROUND \sim
Apply K0 Condition	
Cut-Off Negative Effective Pressure	1:INITIAL GROUND \sim
Initial Stress	
Estimate Initial Stress of Activated Ele	ements
Final Calculation Stage	
End Stage 🛛 Middle Stage	1:INITIAL GROUND \sim
Specify Restart Stage	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Restart Option	
Save only User Specified Stages	
Save only User Specified Stages	
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S	Step
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature	Step
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value	Step 0 [T]
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set	0 [T] None ~
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects	0 [T] None ~
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects Consider Partially Saturated Effects for	0 [T] None ~
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects Consider Partially Saturated Effects for Max. Negative Pore Pressure	Step
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects Consider Partially Saturated Effects for Max. Negative Pore Pressure Max. Negative Pore Pressure Limit	0 [T] None Volume or Stress Analysis 0 0 kN/mm²
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects Consider Partially Saturated Effects for Max. Negative Pore Pressure Max. Negative Pore Pressure Limit Initial Configuration	0 [T] None
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects Consider Partially Saturated Effects for Max. Negative Pore Pressure Max. Negative Pore Pressure Initial Configuration Estimate Initial Configuration of Active	Step It is a constraint of the second seco
Save only User Specified Stages Save All Stages Save All Stages and Last Converged S Initial Temperature Initial Temperature By Value Initial Temperature By Load Set Saturation Effects Consider Partially Saturated Effects for Max. Negative Pore Pressure Max. Negative Pore Pressure Max. Negative Pore Pressure Limit Initial Configuration Estimate Initial Configuration of Activi Undrained Condition	Step I T None T Stress Analysis KN/mm ² ated Nodes

2.1 Complaint Base Function

When using an Outcrop motion as an input motion at the base of the model, a rigid base boundary will not produce correct results. In such cases, we need to
use the Complaint Base function. When the complaint base is used half of the input (downward motion) applied to the ground node is absorbed by the damper,
and half is forwarded to the node of the main ground mesh. In the latest version, the user has the option to choose between Absorbent, Complaint Base, and
Rigid Base.



Generate vertical stress (σ) and traction ($\pmb{\tau}$

Absorbent boundary

Compliant-base

$$\sigma_n = -\rho V_p (\dot{u}_y^m - \dot{u}_y^g) \qquad \sigma_n = -\rho V_p (\dot{u}_y^m - 2\dot{u}_y^g)$$

$$\tau = -\rho V_s (\dot{u}_x^m - \dot{u}_x^g) \qquad \tau = -\rho V_s (\dot{u}_x^m - 2\dot{u}_x^g)$$

Damping coefficient scaling





2.2 Free-Field Ground Damper Function

• A Complaint Base and Absorbent boundary is also developed for the base of the Free-Field Elements. The user will have a choice of choosing the type of ground damper for free-field elements.



Absorbent boundary

$$\sigma_{n} = -\rho V_{p} (\dot{u}_{y}^{m} - \dot{u}_{y}^{g}) \qquad \sigma_{n} = -\rho V_{p} (\dot{u}_{y}^{m} - 2\dot{u}_{y}^{g})$$

$$\tau = -\rho V_{s} (\dot{u}_{x}^{m} - \dot{u}_{x}^{g}) \qquad \tau = -\rho V_{s} (\dot{u}_{x}^{m} - 2\dot{u}_{x}^{g})$$

Damping coefficient scaling



2.3 User-Supplied Soil Material Features

User Supplied Material Library File: Load a custom geotechnical model Library File.

User-Supplied Soil Material Models: Select the model's name of the Library File.

User-Supplied Soil Material Parameters: Enter the value of the parameter defined in the Library File.

Mesh > Prop./CSys./Func. > Material > Create : Isotopic > User Supplied Soil Material

Material			\times	User-defined Values	0	
ID 1	Name Isotropic	Color	~	User-Defined Param	eters	
Madal Turna	Liser Supplied Soil Material			Name	Value	Unit
модеі туре	Oser Supplied Soli Material	~	Structure	E		0 N/m ²
General Doro	us Non-Linear Thermal			NU		0
D:₩Mida User Supp FLASTIC	s₩midas₩developements₩pla: plied Soil Material Models	xis-udsm₩manual-e:	xam 🍙			
User Supp	olied Soil Material Parameters		2			



2.4 Incorporated Soilworks LEM Features

- In the latest version, the Soilworks LEM module is integrated with GTS-NX, and automatic authentication is enabled for GTS-NX.
- The LEM is no longer executed exclusively, and redundant functions have been removed.



2.5 Safety Factor Graph In SRM Execution

In the latest version, the user can check the Safety Factor vs Maximum Displacement Graph in real-time when the analysis is running. This feature is applicable to both direct SRM analysis as well as SRM in Construction Stages.



2.6 Boundary Condition For SRM & In-Situ in Nonlinear Time History + SRM Coupled

The dynamic boundary conditions applied to the model may not be suitable for SRM and Insitu analysis. In the latest version, the user has a choice to choose a different boundary condition for Insitu and SRM analysis. This feature is applicable for all Time History Analyses as well as Construction Stage Stress – Nonlinear Time History Analysis.

	Add/Modify Analys	sis Case				×	
	Analysis Case Se	tting					
	Title	nonliinear timehistory			Time Step	PO	
	Description				Analysis Control	94	
	Solution Type	Nonlinear Time History + SR	M	~	Output Control		
Analysis Cases	Construction Sta	ge Set	Construction Stage Set-1	v	ouput control		
inear Time History(Modal)	Analysis Case Mo	del					
inear Time History(Direct)		All Sets	<< >>	Active	Sets		
Ionlinear Time History + SRM construction Stage Stress-Nonlinear Time History	Boundary Dynamic Dynamic Contact P	(Condition Load 'air	Sound	aut wesh set ary Condition ic Load #Pair ary Condition (In-S	titu & SRM)		
				6			



2.7 Concrete Smeared Crack Model

The concrete smeared crack model simulates the compression part of concrete using a typical isotropic elasto-plastic model, and the tensile part of concrete is simulated using a smeared crack model. The smeared crack model is a method of simulating the crack by adjusting the stress and stiffness at the integration point, without reconfiguring the mesh.



2.8 Concrete Damage Plasticity Model

The Concrete Damaged Plasticity Model is now available in midas GTS NX. It provides a general capability for modeling concrete and other quasi-brittle materials including masonry and is designed for applications in which concrete is subjected to dynamic loading due to earthquakes under low confining pressures.

2.8 Concrete Damage Plasticity Model

Using this model, the following behaviors of concrete can be described. Different behaviors for tension and compression. Different reductions of the elastic stiffness when unloading for tension and compression. Stiffness recovery effects during cyclic load reversals.

2.9 Fatigue Analysis

- Fatigue analysis can be performed based on stress (stress-life method) and strain (strain-life method).
- Fatigue lifecycle and fatigue damage can be viewed for the various mean stress correction methods, i.e., Goodman, Gerber, etc.

MIDAS

Happy Modeling!!

