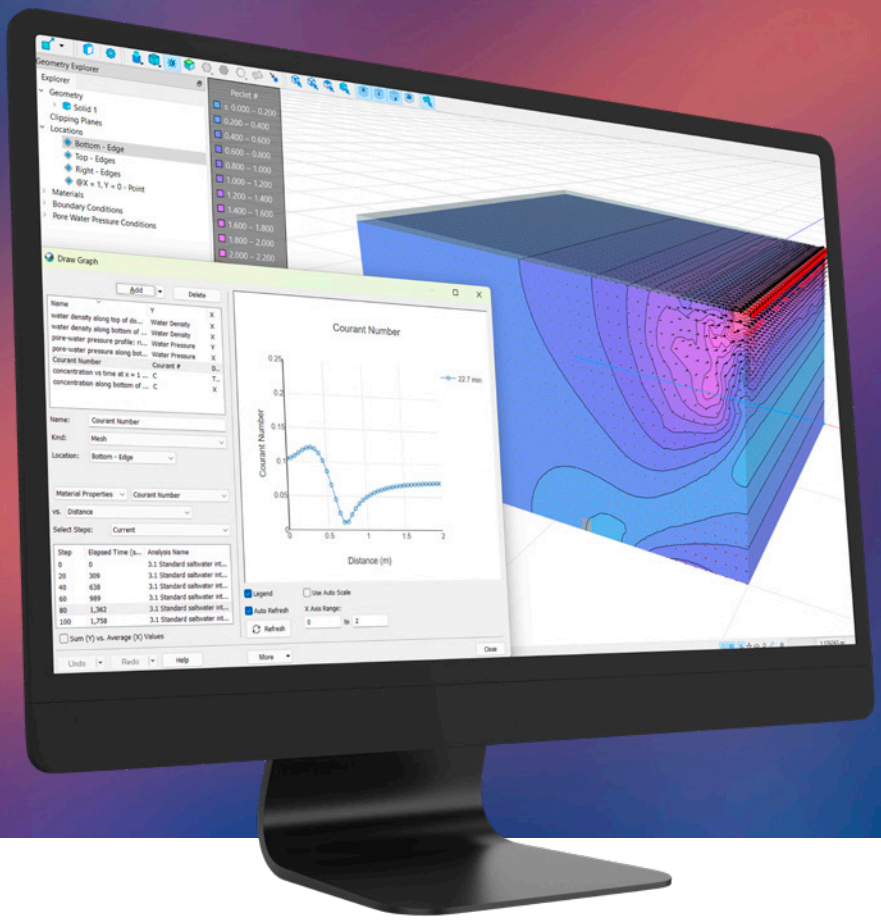
SEEQUENT | UNDERSTAND THE UNDERGROUND

GeoStudio

GeoStudio **2025.1**

# new release




## Release Notes

GeoStudio 2025.1 offers a balanced mix of new functionalities and enhancements to our core tools. This version introduces Python scripting, enabling more efficient workflows, and 3D reinforcement analysis for better slope stability assessments.

Additionally, we've made powerful improvements to the automatic search algorithm for limit equilibrium analysis, introduced advanced capabilities for defining point and line arrays in three-dimensional geometries, and enhanced the calculation of pull-out capacity for reinforcement. The release also features significantly improved graphing capabilities, refined 3D mesh refinement, and more, all designed to streamline your geotechnical projects and deliver high-quality engineering solutions.

# Table of Contents

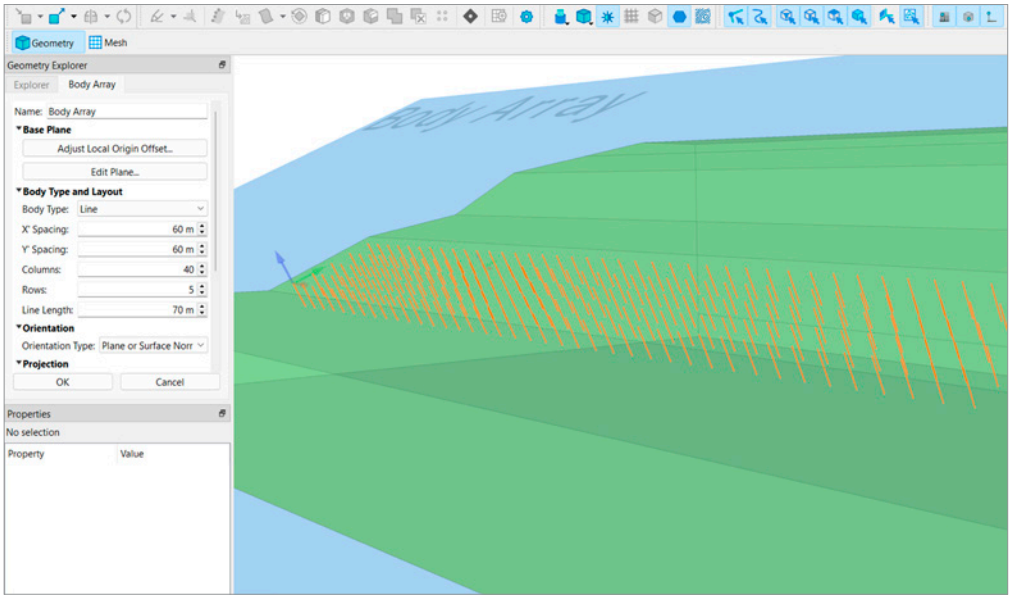


GeoStudio

# New and improved features in GeoStudio 2025.1

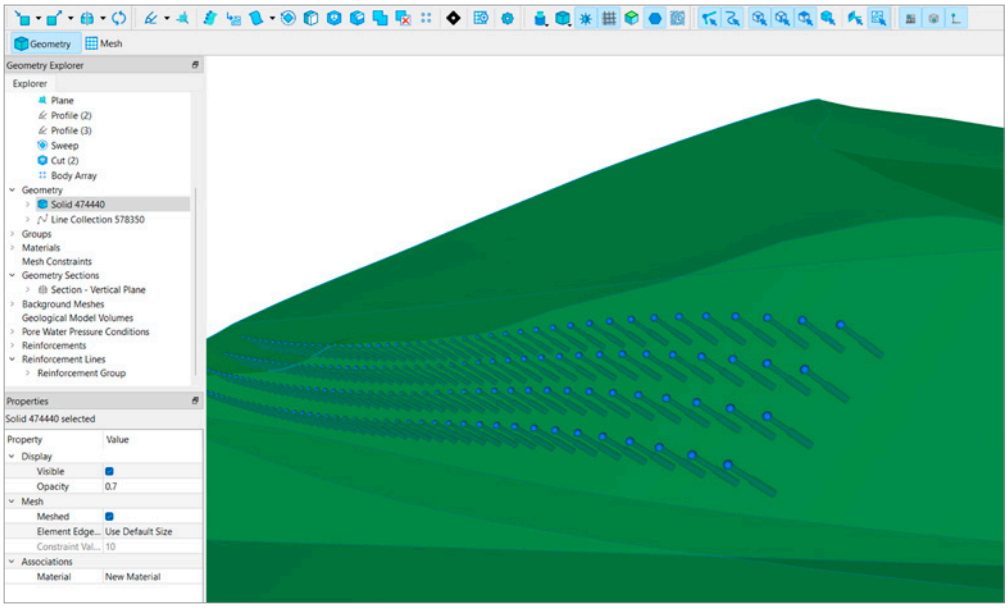
## New Array Tool in 3D

In civil and mining projects, accurately defining and analysing reinforcement within three-dimensional geometries is a critical yet complex task. Traditional CAD tooling often falls short in providing the capability to define the geometry representing nails, anchors, and piles. A similar problem exists in dewatering or artificial ground freezing problems in which boundary conditions are applied to lines in 3D space. GeoStudio 2025.1 introduces advanced capabilities for defining point and line arrays in three-dimensional geometries. By solving this problem, we aim to streamline workflows and support our customers in delivering high-quality engineering solutions.



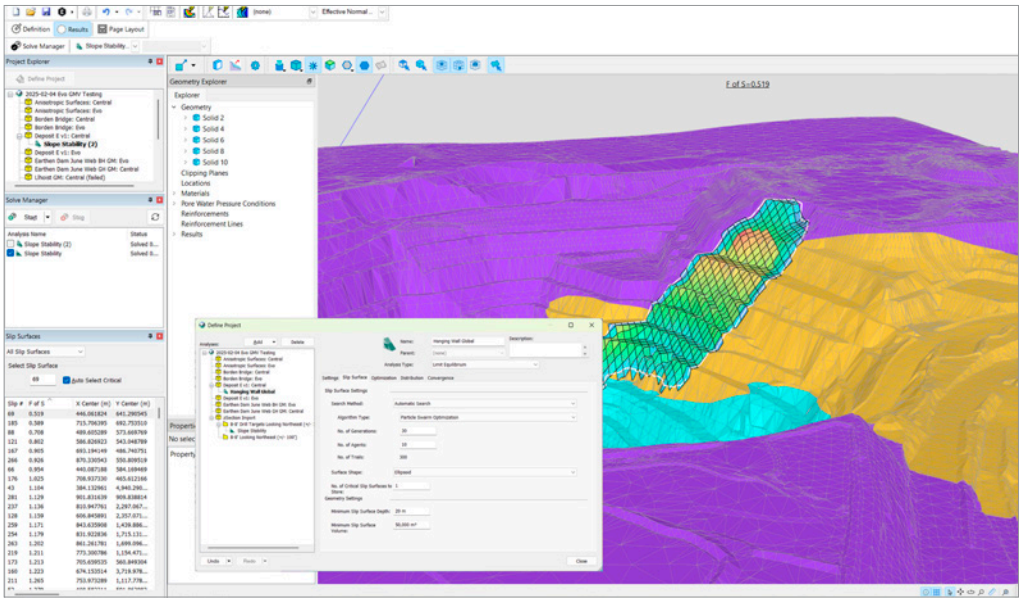

## Reinforcement in 3D

GeoStudio 2025.1 now includes the capability to analyse the effect of reinforcement on the factor of safety in 3D limit equilibrium analysis. This feature allows geotechnical engineers to incorporate various types of reinforcement including anchors and soil nails into their 3D models. This enhancement addresses a critical need in geotechnical engineering, where reinforcement analysis is essential for ensuring slope stability and safety. By expanding this functionality to 3D, GeoStudio 2025.1 provides users with a more comprehensive and robust tool for their geotechnical projects.



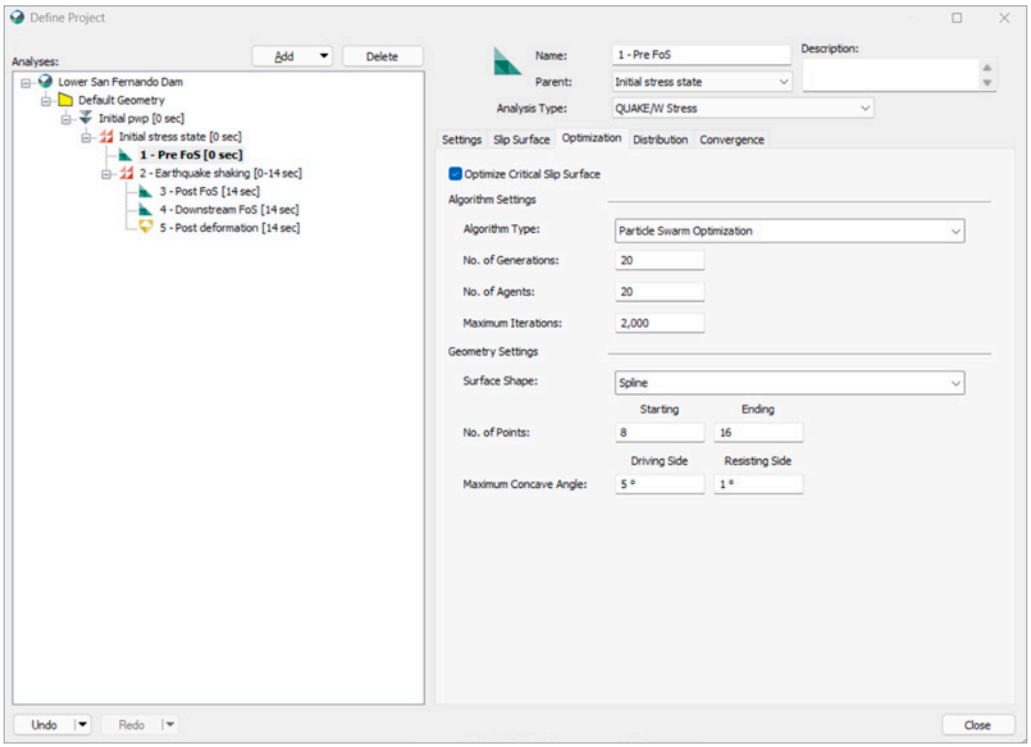
## Automatic Slip Surface Search in 2D and 3D

Powerful enhancements have been made to the automatic search algorithm for limit equilibrium analysis. While the Circular Search Cuckoo was introduced in previous releases, the new version now includes a non-circular search option. This feature is particularly valuable for domains involving anisotropy, where non-circular failure surfaces are more representative of real-world conditions. The new release also expands 2D and 3D capabilities by incorporating several advanced algorithm options, including Particle Swarm Optimization, Differential Evolution, Downhill Skiing Algorithm, Genetic Algorithm, and Pure Random Optimization. This improvement supports more robust geotechnical designs and informed decision-making as various search techniques can be compared to ensure the most critical mode of failure has been identified.



## Enhanced Slip Surface Optimization in 2D and 3D

Advanced optimization algorithms for determining the shape of the critical slip surface in 2D and 3D limit equilibrium analysis have been introduced. The new release includes 2D optimization using polylines and splines, as well as advanced algorithms such as Particle Swarm Optimization, Differential Evolution (DE), Cuckoo Search, and Random Walk. These enhancements enable users to identify the critical slip surface shape in complex geological settings more effectively, thereby reducing risk.



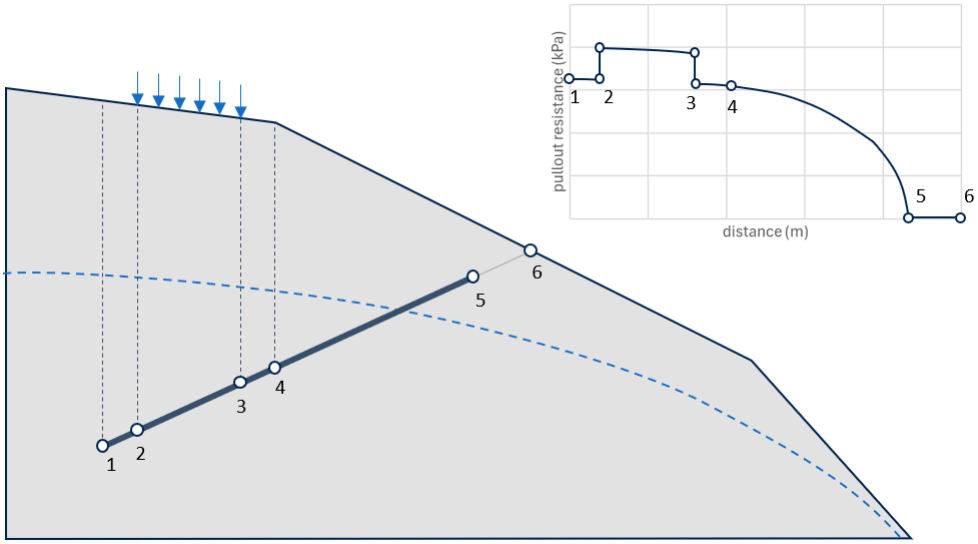
## Python Scripting API for GeoStudio

We are excited to introduce a powerful new feature that unlocks the full capability of GeoStudio: a python scripting API. Scripts can be used, for example, to automate repetitive tasks such as updating a piezometric surface based on sensor data and interfacing with 3rd party inverse modelling applications to calibrate material model parameters. The scripting services also allow results to be extracted from an analysis, even if those results were not cached in the project file, making it possible to generate graphs of any parameter. By leveraging the power of scripting, users can push the boundaries of what's possible in GeoStudio, leading to more innovative and optimized project outcomes.

## Improved Integration of Reinforcement Pull-Out Capacity

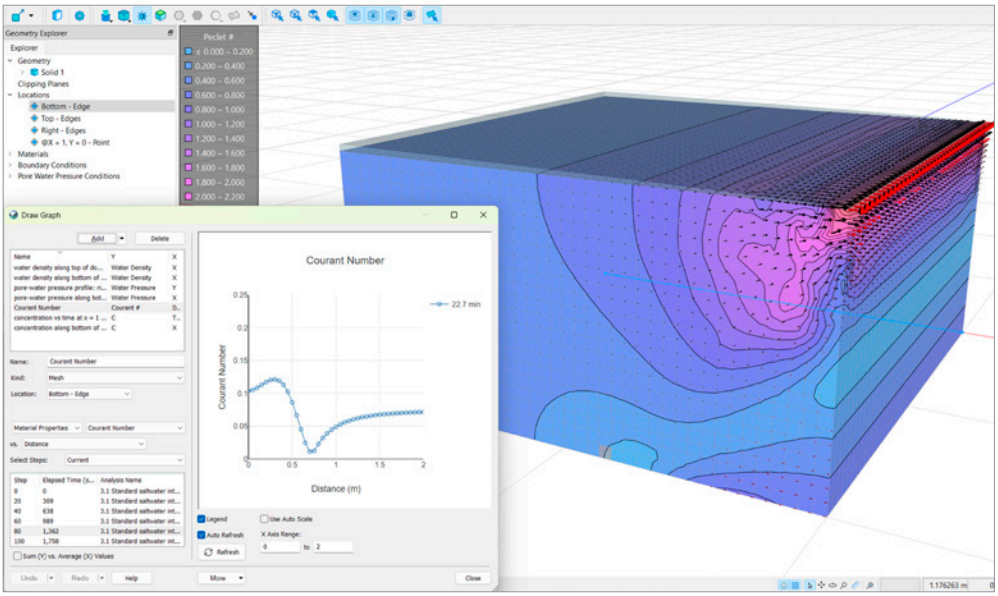
Our latest enhancement for 2D and 3D slope stability software improves the calculation of pull-out capacity for reinforcement. Previously, the pull-out capacity was determined based on the effective stress at the intersection of the slip surface and the reinforcement. This method overlooked the increasing confinement stress with depth, especially for angled reinforcement.

With our new approach, the pull-out capacity is numerically integrated along the entire bonded length of the reinforcement. This advanced method captures the effects of non-uniform ground surface profiles and dipping reinforcement, providing a more accurate and reliable assessment of slope stability and more cost-effective projects.



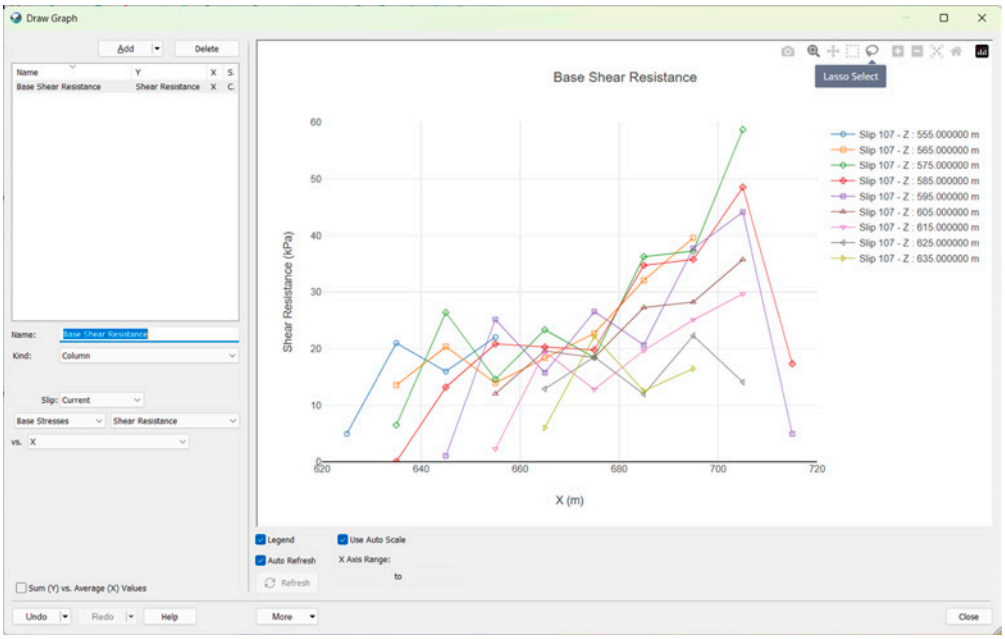

## Peclet and Courant Numbers in 3D

The Péclet and Courant numbers can now be visualized in 2D and 3D heat transfer analyses. These dimensionless numbers are crucial for understanding the numerical stability of the solution. The Péclet Number compares the relative importance of convection to conduction, thereby imposing a control on mesh size, while the Courant number is important for time-step selection in convection dominant systems. By visualizing these numbers, engineers and scientists can better understand the dynamics of advective heat transfer, minimize numerical dispersion and oscillation, and ensure accurate simulation results.



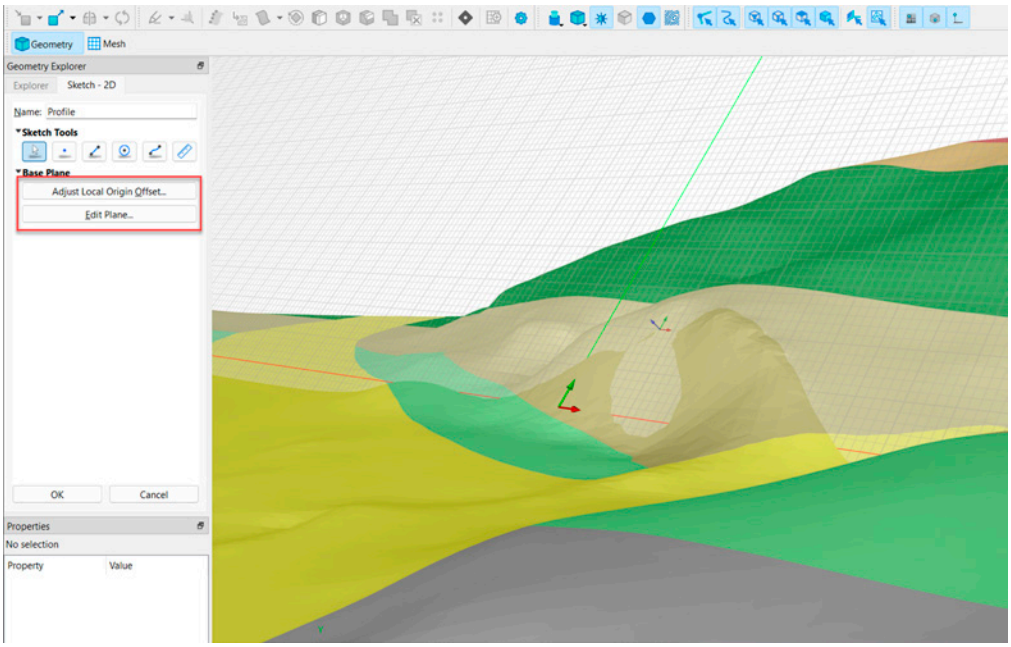
## New Graphing Technology

GeoStudio 2025.1 introduces a significantly enhanced graphing capability, addressing the cornerstone of numerical analysis interpretation. The new graphing technology offers a richer, more user-friendly experience, aligning with contemporary software standards. This upgrade allows for more precise and customizable graph generation, enabling users to better visualize and interpret their numerical analysis results.




## Improvements to 2D Sketching for 3D Model Building

The 2D sketching capability in GeoStudio 3D has significantly better user experience. The new functionality allows users to edit the local origin coordinate, providing greater flexibility and control in 2D sketching. These improvements save time and enhance accuracy, making the sketching process more intuitive and efficient.



## Thermal Dispersion in Heat Transfer Analysis

Thermal dispersion refers to a phenomenon in which heat transfer occurs due to hydrodynamic mixing. As solute dispersion is generally important for solute transport in porous media, thermal dispersion should also be considered for heat transport. Unlike pure conduction, which relies on temperature gradients, or convection, which involves heat transfer with a moving fluid, thermal dispersion accounts for the interplay of these mechanisms. The addition of a thermal dispersion coefficient in GeoStudio means that TEMP/W and TEMP3D can better capture real-world systems, particularly with fast moving groundwater flow.

## New Thermal Conductivity Estimation Routines

GeoStudio 2025.1 significantly upgrades the estimation of thermal conductivity for porous media by incorporating industry-standard routines based on widely accepted techniques. The new release integrates advanced estimation methods, such as de Vries (1963), Johansen (1975), Côté and Konrad (2005), and Lu et al. (2007). These enhancements ensure more accurate and reliable predictions of thermal conductivity, thereby expanding GeoStudio's capabilities to model geotechnical heat transfer problem in a robust manner.

## Performance Improvement to FE Solver

2025.1 continues with the improvements to finite element solve times with additional optimizations to the matrix routines, resulting in solve times that are up to 20% faster for stress strain analyses.

## Improved Mesh Refinement in 3D

GeoStudio 2025.1 introduces significant improvements to 3D mesh refinement, addressing the needs of geotechnical analyses involving small geotechnical features such as thermosyphons, artificial ground freeze pipes, de-watering wells, and sand point wells. The new implementation ensures a smoother transition from fine to coarse mesh, enhancing the resolution around these features and improving the application of boundary conditions. By providing a more gradual and precise mesh refinement, the new version enhances the fidelity of results in critical areas of interest.

# Bug Fixes and Changes

## GeoStudio

- Material names associated with a Weak Surface did not display fully in the dropdown list.
- Analysis reports for probabilistic analysis are inconsistent between SLOPE/W and SLOPE3D.
- CTRAN/W and CTRAN3D gas transfer simulations would not solve if a source concentration and/or a free exit boundary condition were applied to the domain but advection with air flow was not toggled on.
- Cursor coordinates do not update when using Modify Object.
- Default graphs are not included in new SLOPE3D and SEEP3D analyses.
- Sorting the slip surfaces by DoU in Descending order now places the critical slip at the top, and all E99 appear at the bottom.
- Generating a report using GeoCmd produces an incorrect error message for upgraded files.
- GeoStudio 3D could terminate when switching between 2D and 3D analyses after changing view preferences in a 2D analysis.
- Fixed UI validation for the OCR function in the SHANSEP model to enforce a minimum value of 1.
- The user interface experiences a significant lag when setting the probabilistic inputs for pore water pressure conditions.
- Improved time step display in result graphs by removing ‘year’ conversion and increasing precision to 4 significant digits.
- A UI verification error was not displayed when values for water or air content exceeded 1.0.

## GeoStudio 2D

- Fixed a crash when applying surcharge loads to ground surfaces with a very high number of points.
- Fixed a crash that would occur viewing results if the View Preference for the Liquefaction Zone was on when Liquefaction it is not applicable to the analysis.
- 2D models created from imported geometry would sometimes produce reversed text when exporting to DXF/DWG from GeoStudio.
- Renaming a 2D section generated from GeoStudio 3D does not change name of the source section.
- Solver crash in Quake/W with specific function inputs in material models
- AutoCad export produces erroneous DXF/DWG
- Fixed an issue in SLOPE models where B-bar pore pressure from surcharge load was ignored when ‘Add Weight’ for all soil layers was unchecked.
- GeoStudio may crash when opening a file with two points that nearly overlap and one of the points has a mesh constraint.
- Show correct number of nodes for a 1D geometry when viewed through mesh properties.
- Ensured the estimation of the E-Modulus function in material models is independent of the unit system.
- Enhanced the accuracy of gravitational acceleration values in the QUAKE solver, which may cause minor differences in results.
- Restored display of trial slip surfaces outlines blue highlight during mouse hover that was lost.
- Reinforcement force arrows have the incorrect orientation when more than one reinforcement intersects the same column base.

## GeoStudio 3D

- Resolved an issue in probabilistic analysis where the seed value for random number generation was not applied consistently in the Monte Carlo (default trials) and Latin Hypercube methods.
- Isosurfaces are displayed incorrectly at the interface between active and inactive solids.
- Text associated with Ruler tool is more visible at any scale
- Graph locations are not maintained after remeshing.
- Multi-selection of geometry objects in Mesh View does not highlight the associated materials or boundary conditions in the Groups folder.
- The correct selection tool did not automatically become active when executing a command.
- Point bodies on the face of solids could be difficult to visualize from certain camera views.
- Fixed poor display of swept cylinders that occurred in some cases.
- Visibility settings for ponding could be lost when switching between geometries and analyses.
- Contour elevation numbers (wrong step) are displayed above the isosurface
- Fixed a crash in SLOPE3D when saving the Report of an invalid slip surface with certain error codes.
- Mesh refinement could lead to a crash under certain circumstances.
- Edges of bodies cannot be selected after deleting an adjacent body.
- Material associations are lost when a Cut operation is suppressed and then unsuppressed.
- Contours of certain parameters would be displayed in solids with the material set to ‘none’.
- The sign on the X/Z components of the seismic force could be wrong if the sliding direction had a North component and the horizontal earthquake coefficient was relatively significant.