

**Griddle**<sup>TM</sup> VERSION 2.0  
Advanced Meshing Tools for  
Numerical Modeling

# What is new in *Griddle* Version 2.0

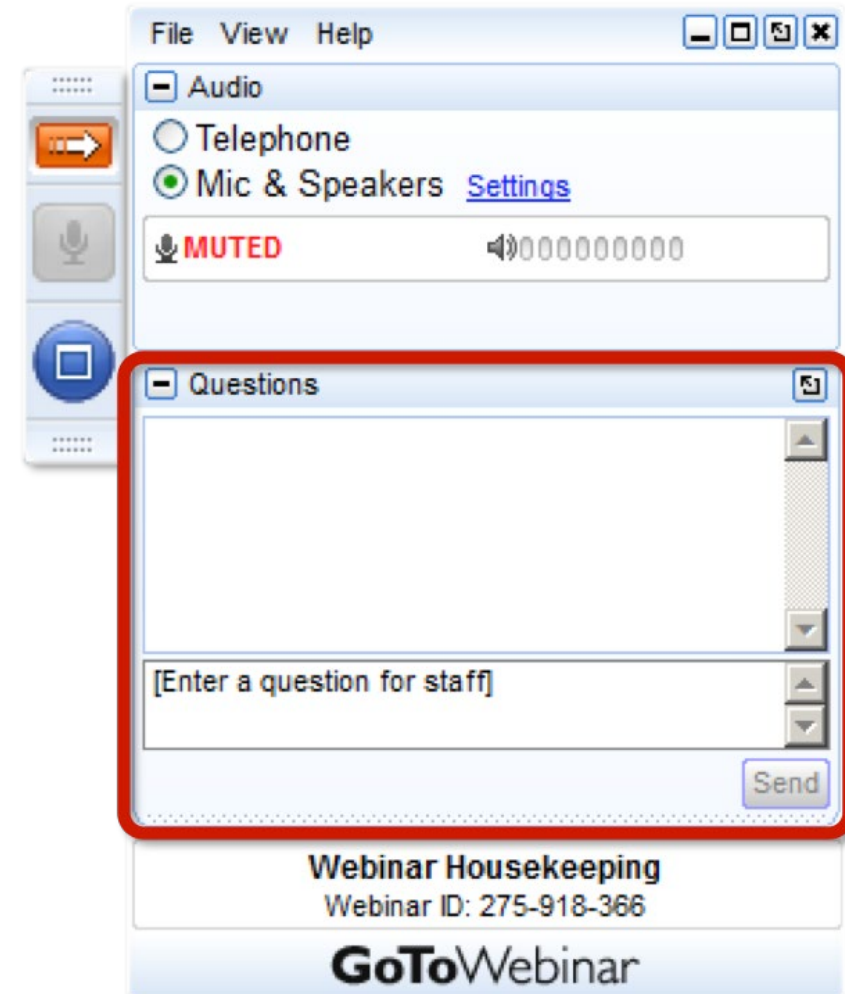
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January 2021

# Information

To type your questions, please use **Questions** dialog in the **GoToWebinar** window.

Questions will be answered at the end of the webinar.



# Griddle

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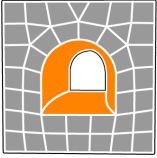
- What is *Griddle* and *Rhino*?
- General improvements
- Improvements in structured meshing
- Improvements in unstructured meshing tools
- New and improved meshing utilities
- Using *Griddle* in *Rhino* scripting and development
- What's next?

# Poll 1 & 2

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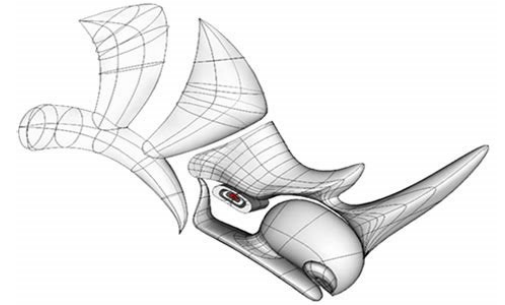
- What industry/science are you associated with?
  - ❖ Mining
  - ❖ Civil / Geotechnical
  - ❖ Energy (oil & gas, geothermal)
  - ❖ Manufacturing
  - ❖ Other
- Have you used *Griddle* before?
  - ❖ I am using / have used *Griddle* v1.0
  - ❖ I am already using *Griddle* v2.0
  - ❖ I have not used *Griddle* but familiar with *Rhino*
  - ❖ I am not familiar with either *Griddle* or *Rhino*

# What is *Griddle* and *Rhino*?



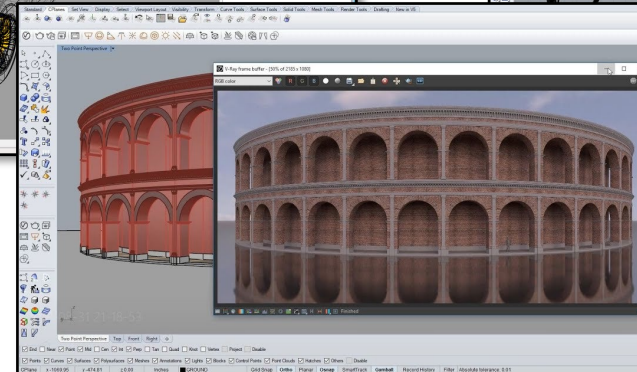
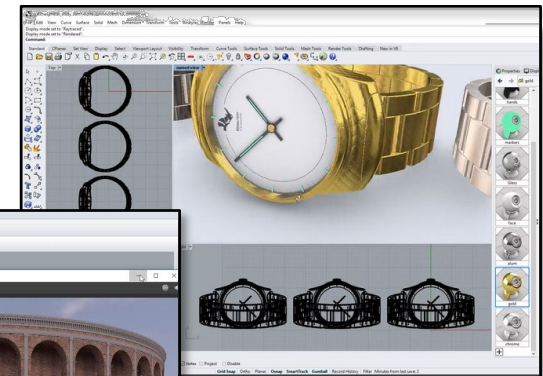
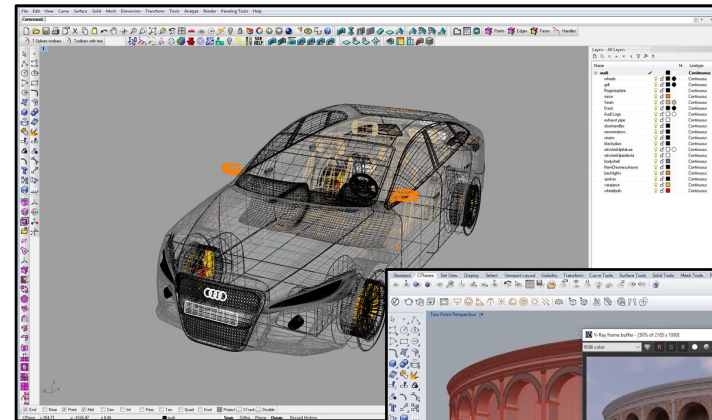
**Griddle is a general-purpose meshing plugin for *Rhino* CAD system**

***Rhinoceros (Rhino)* is a free form surface modeler**  
(used for CAD/CAM in architecture, industrial design, engineering, graphics design, etc.)



*Rhino* operates with:

- Nodes / Point Clouds
- Curves / Polylines / Splines
- Surfaces / Polysurfaces
  - BRep
  - NURBS
  - SubD (only in Rhino 7)
- **Surface Meshes**



- *Griddle* utilizes and extends *Rhino* capabilities related to meshing



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# Poll 3

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- Most of the time, for what software do you (plan to) create meshes?
  - ❖ *FLAC3D*
  - ❖ *3DEC*
  - ❖ FEM (*Abaqus / Ansys / LS-DYNA / Nastran*)
  - ❖ Other

# Griddle

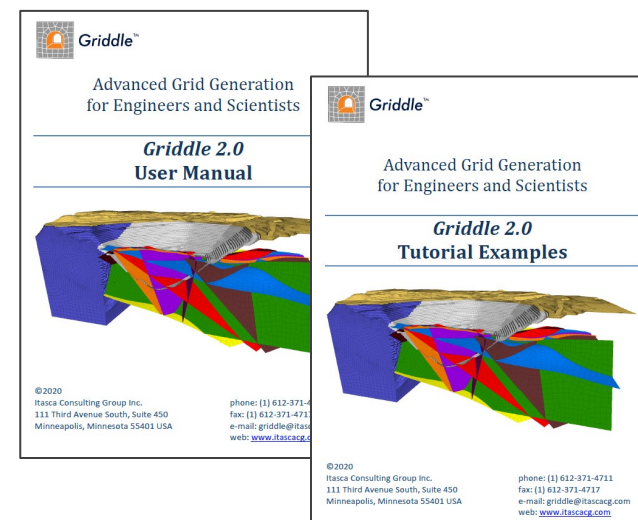
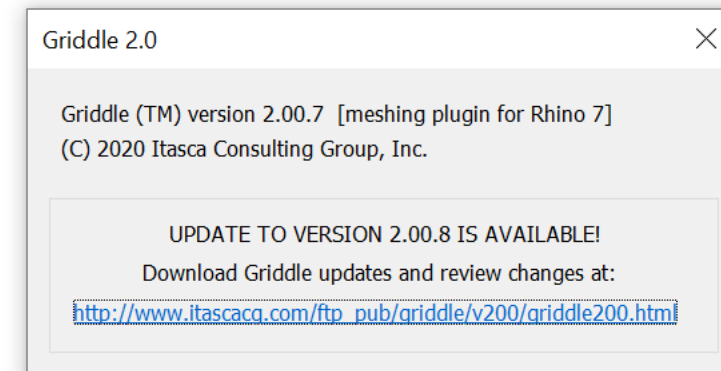
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# General Improvements

- New installer:
  - ❖ automatically removes previous versions of *Griddle* (from *Rhino* 5, 6, 7)
  - ❖ automatically installs *Griddle* components and integrates in *Rhino* 6, 7
- Automatic checks for updates  
(if *Griddle* 2.0 update is available, an information message will be shown when closing *Rhino*)
- Revised and improved embedded documentation  
(within *Rhino*'s HELP pane)
- Consistent output file naming and better project management
- Consistent security logic
- New and updated User Manual and Tutorial Examples



# Griddle

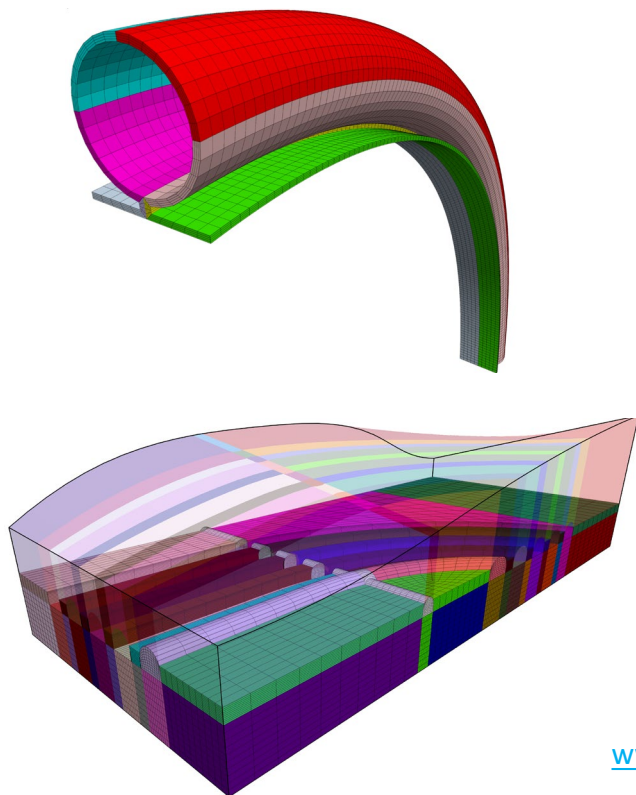
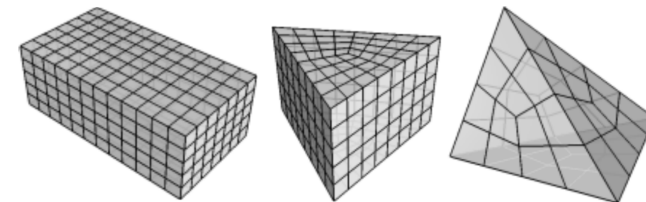
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# Improvements in Structured Meshing

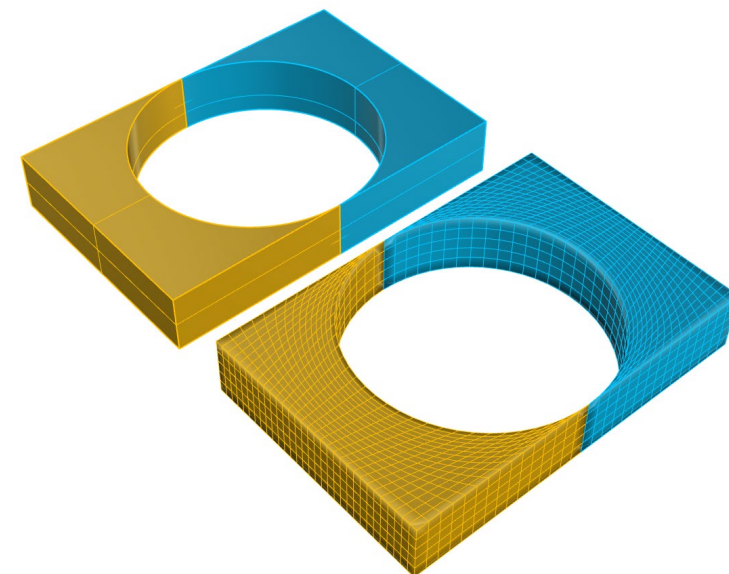


**BlockRanger** is a structured hexahedral volume mesher that operates directly on 4, 5, or 6-sided solids represented by BRep. **BlockRanger** creates volume meshes by discretizing the solids.



## **Main improvements:**

- Ability to handle concave solids
- More robust meshing engine  
(attempts to fix improperly connected solids before meshing)
- Creation of boundary surface meshes from solids' volume meshes
- Additional output formats  
(*FLAC3D* binary, *3DEC 7* text/binary, CSV)



[www.itascacg.com/learning/webinars](http://www.itascacg.com/learning/webinars) : How to create a hybrid mesh by combining *BlockRanger* and *Griddle*

# Improvements in Structured Meshing

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## *BlockRanger* Demo

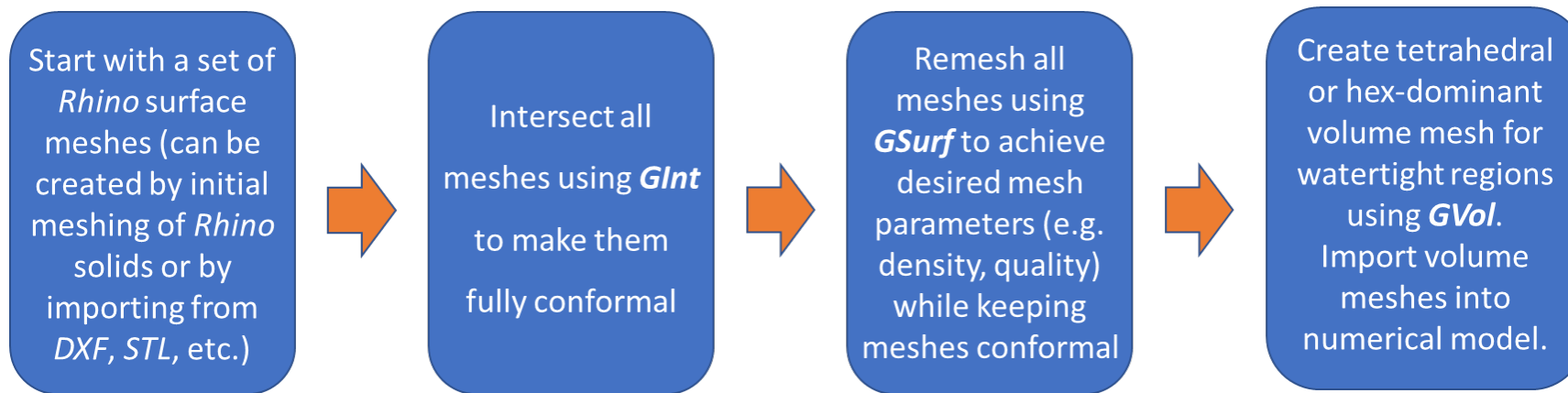
# Griddle

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# Unstructured Meshing Tools

- ***GInt*** – surface mesh intersector
- ***GSurf*** – unstructured surface mesh remesher
- ***GVol*** – unstructured hex-dominant volume mesher



Typical workflow for unstructured meshing using *Griddle* tools.

# Improvements in Unstructured Meshing Tools



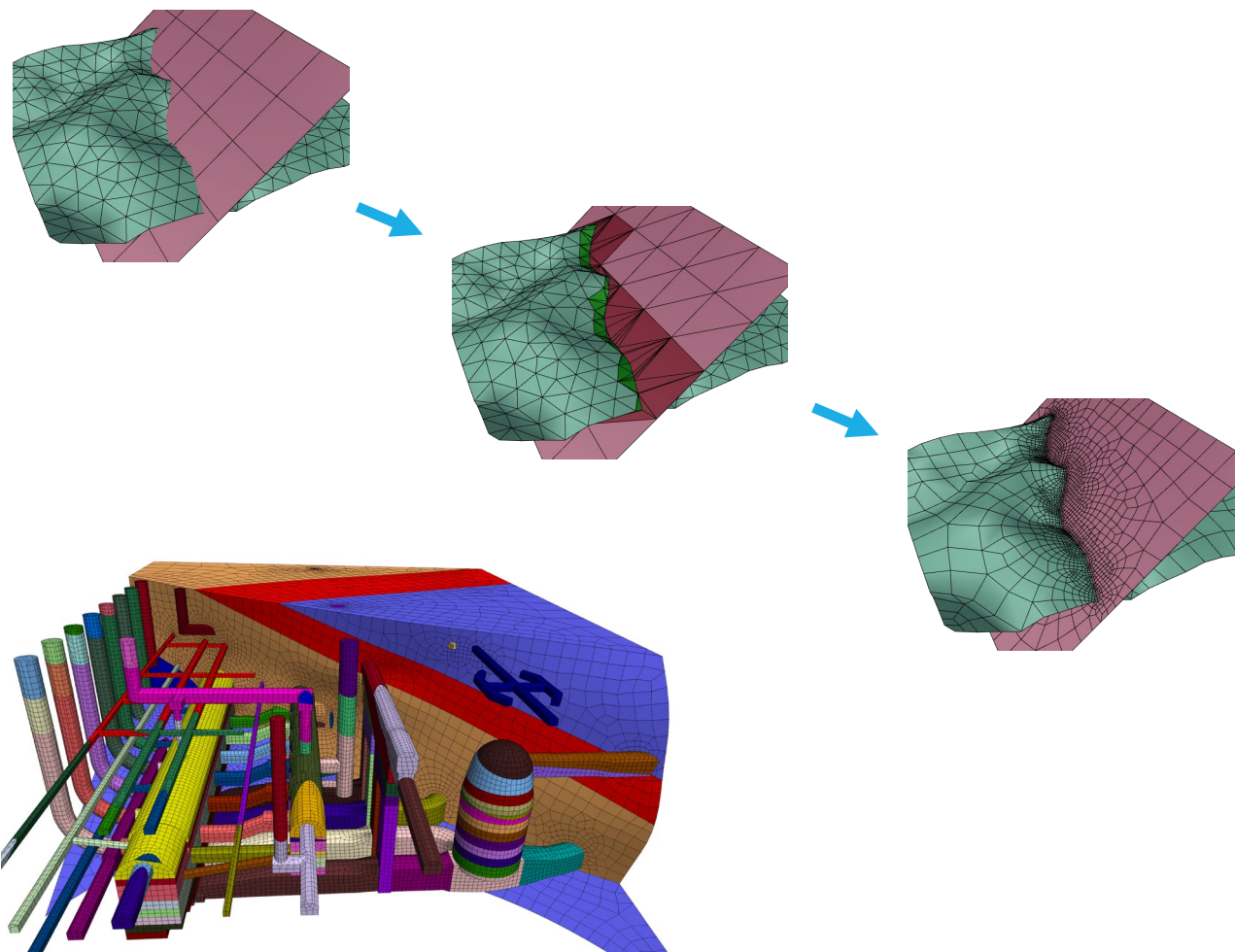
## Surface mesh intersector - **GInt**

- Keep meshes merged / separated after the operation
- Preserve mesh attributes after intersecting
- Split intersected faces and put into separate layers



## Surface mesh remeshing - **GSurf**

- Faster and more robust engine
- Keep meshes merged / separated after the operation
- Preserve mesh attributes after remeshing
- More meshing controls (gradation, quad weight, shape quality, optimization)
- Local mesh size can be specified via URL field to preserve mesh name
- Improved/faster logic for hard edges and nodes and local mesh size



# Improvements in Unstructured Meshing Tools

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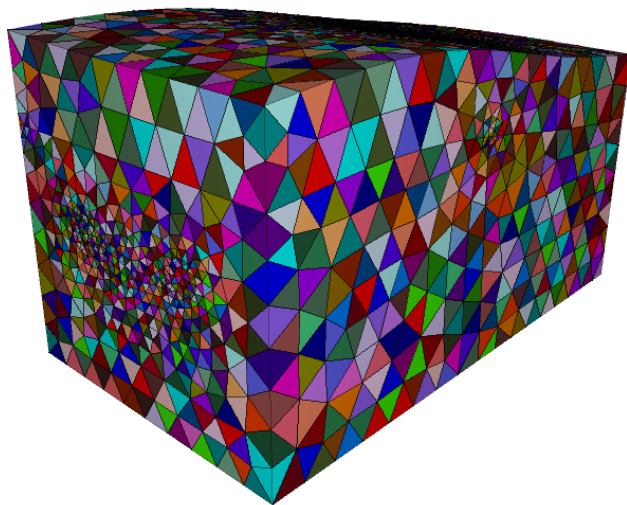
***Glnt*** and ***GSurf*** Demo



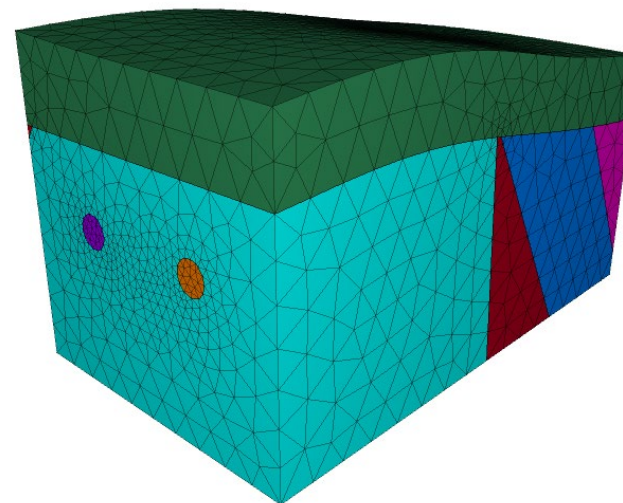
# Improvements in Unstructured Meshing Tools

## Unstructured volume mesher - **GVOL**

- Faster and more robust engine
- More meshing controls (gradation, shape quality, optimization)
- Automatic check for surface mesh problems before volume meshing
- New output formats: *3DEC* 7 Rigid/Deformable, *3DEC* & *FLAC3D* text and binary, *CSV*
- More detailed logs



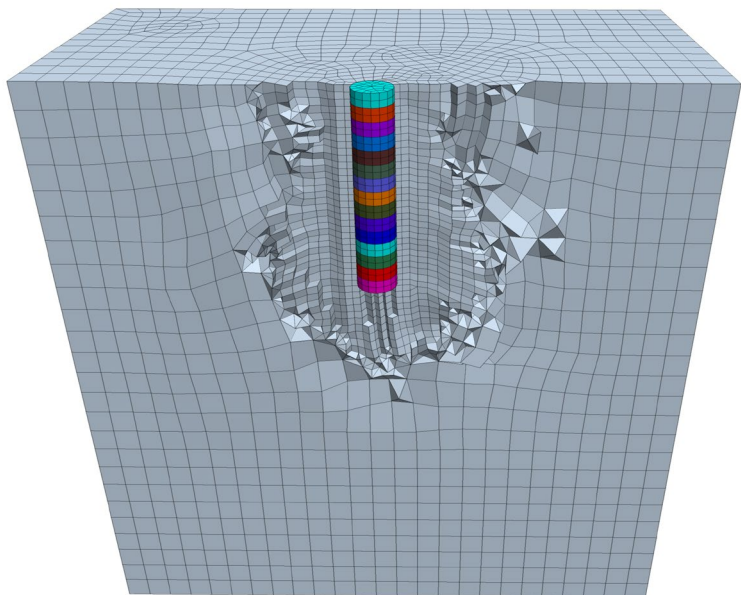
**3DEC 7 Rigid output format**



**3DEC 7 Deformable output format**

# Improvements in Unstructured Meshing Tools

## **GVol** standard parameters



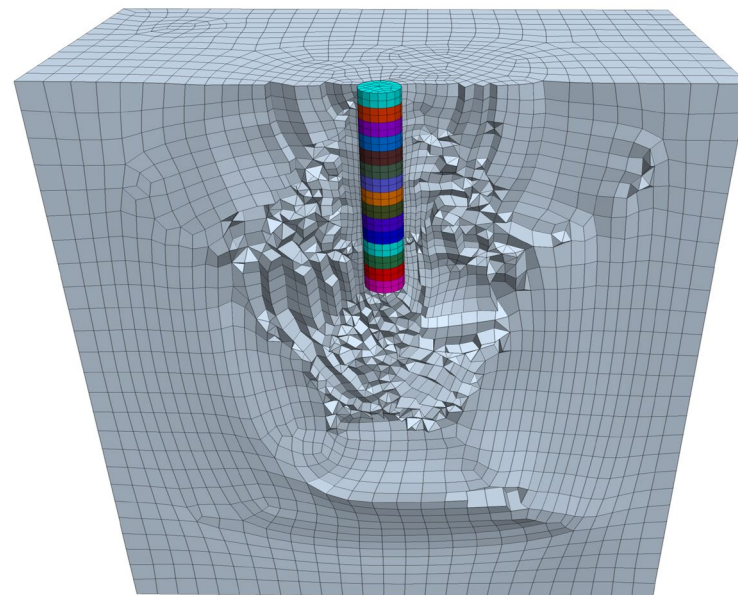
### Number of elements:

total: **43899**

hexahedra: 57.8% / 96.7% of volume  
prisms: 2.4% / 0.4% of volume  
pyramids: 21.1% / 2.1% of volume  
tetrahedra: 18.7% / 0.8% of volume

Mode: HexDom  
Gradation: -  
Target size: 0.0  
Optimization: 5  
Shape Quality: 0.75

## **GVol** custom parameters



### Number of elements:

total: **57484**

hexahedra: 55.1% / 96.2% of volume  
prisms: 2.8% / 0.5% of volume  
pyramids: 24% / 2.5% of volume  
tetrahedra: 18.2% / 0.8% of volume

Mode: HexDom  
Gradation: 0.5  
Target size: 8.0  
Optimization: 10  
Shape Quality: 0.5

# Griddle

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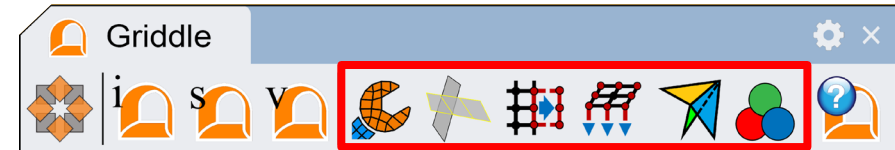
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# New and Improved Meshing Utilities



## Mesh healing tools – **GHeal**

- *ShowErrors* mode
- *AutomaticHeal* mode
- *CustomHeal* mode = *Rhino's MeshRepair* command



## Mesh / Faces extraction tools – **GExtract**

- *SingleSurface*
- *AllSurface*
- *BoundaryFaces*
- *NonManifoldFaces*
- *SurfacesWithinSolids*



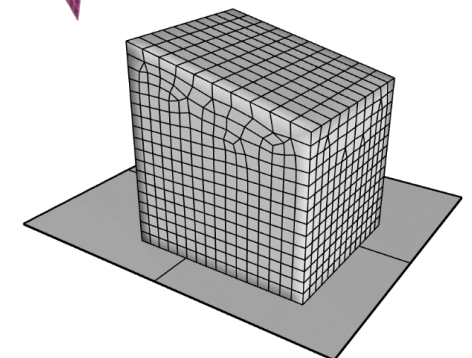
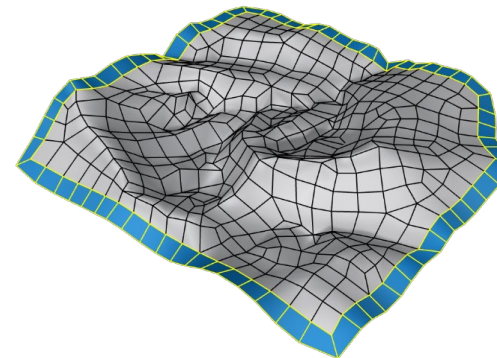
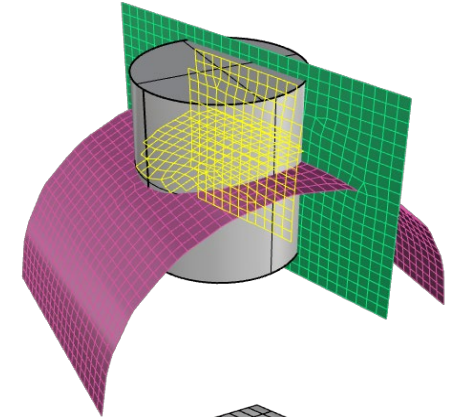
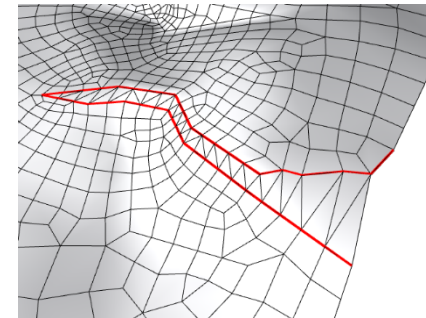
## Mesh extension tools – **GExtend**

- *ExtendSelectedBoundary* mode
- *ExtendAllBoundaries* mode
- *FreeExtend* mode



## Mesh extrusion tools – **GExtrude**

- *Extrude a mesh along its border to specified bounding surface*



# Demo examples

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- Meshing Utilities Demo
- Full application examples:
  - ❖ Direct shear test
  - ❖ Creating hybrid mesh (structured + unstructured) – *Rhino 7*
  - ❖ Design of a slope with a roadway – *Rhino 7*

# Griddle

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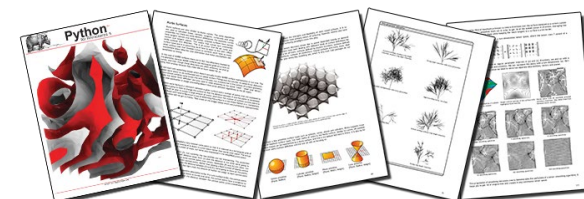
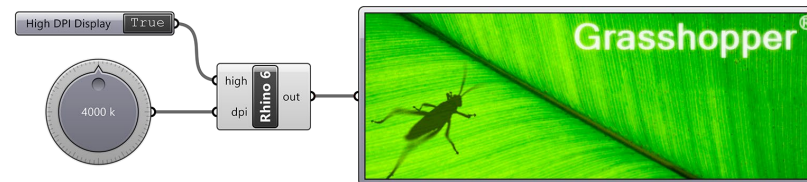
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# Using *Griddle* in Scripting and Development

*Rhino* offers extensive developer tools for creating scripts and plugins:

- *Grasshopper* (visual programming language)
- *RhinoScript* (based on VBScript)
- *Rhino.Python* (based on Iron Python 2.7)
- *RhinoCommon* C# (.NET) SDK  
(can be invoked from *Rhino.Python*)
- *Rhino* C++ SDK



***Griddle* commands can be called from any of  
*Rhino* development environments!**

# Using *Griddle* in Scripting and Development

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## Tunnel DFN Demo



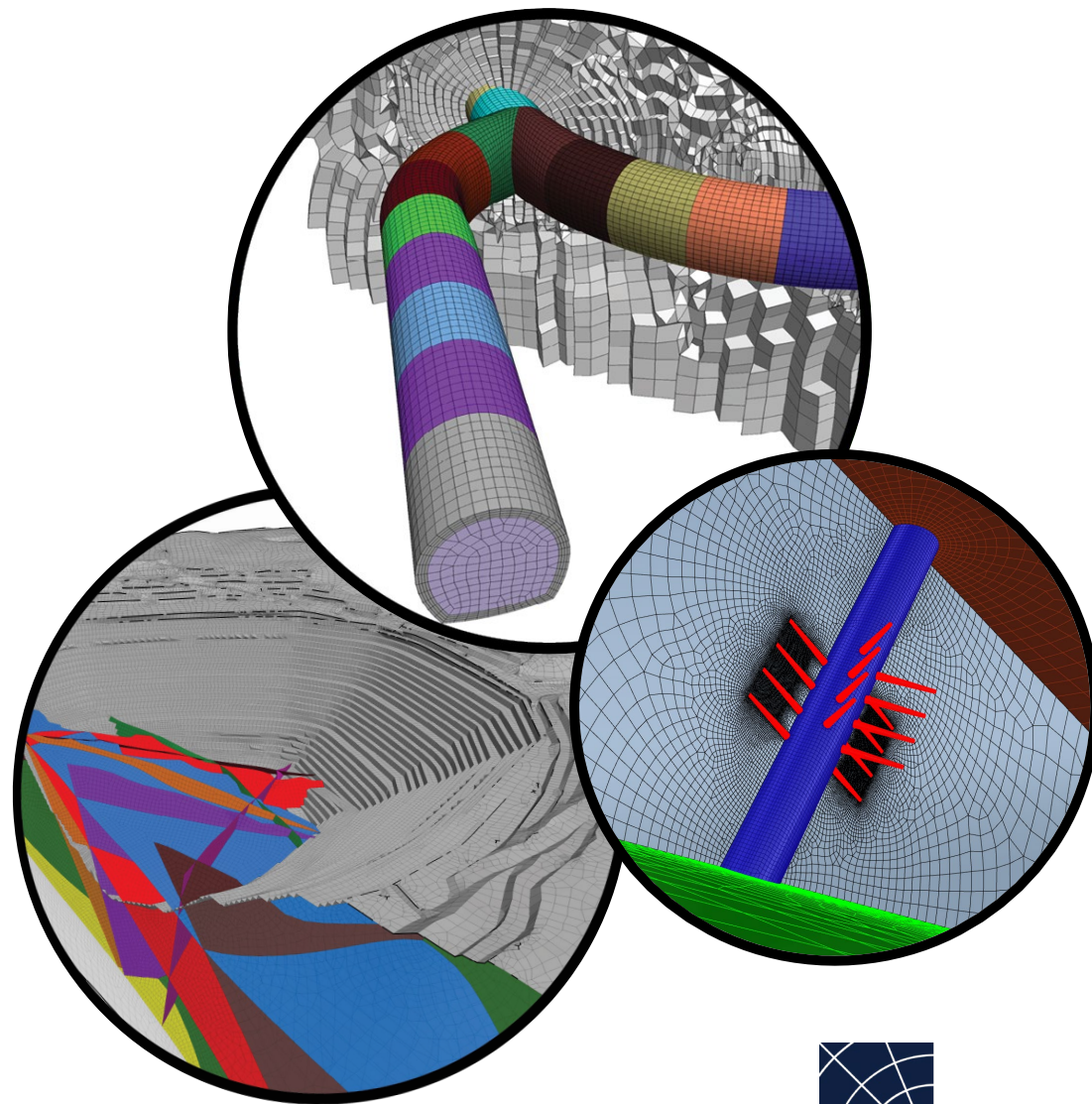
# Griddle

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# What's Next

- Web licensing
- Boundary, background and anisotropic meshes
- Functionality to mesh closed volumes individually
- Visualization of volume meshes / specific elements / groups in *Rhino*
- Improvements in volumes/surfaces grouping logic
- Tighter integration between structured and unstructured meshing
- Improvements and new tools to operate with surface meshes (e.g., *GHeal*, *GExtract*, etc.)
- More capabilities for FEM output
- Optimization, multithreading



# Thank you

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- A recording of this webinar will be available to the registrants shortly
- Questions?

Try the Demo software for free: [www.itascacg.com/demos](http://www.itascacg.com/demos)

Learn more: [www.itascacg.com/griddle](http://www.itascacg.com/griddle)