COMSOL Multiphysics® 6.1.

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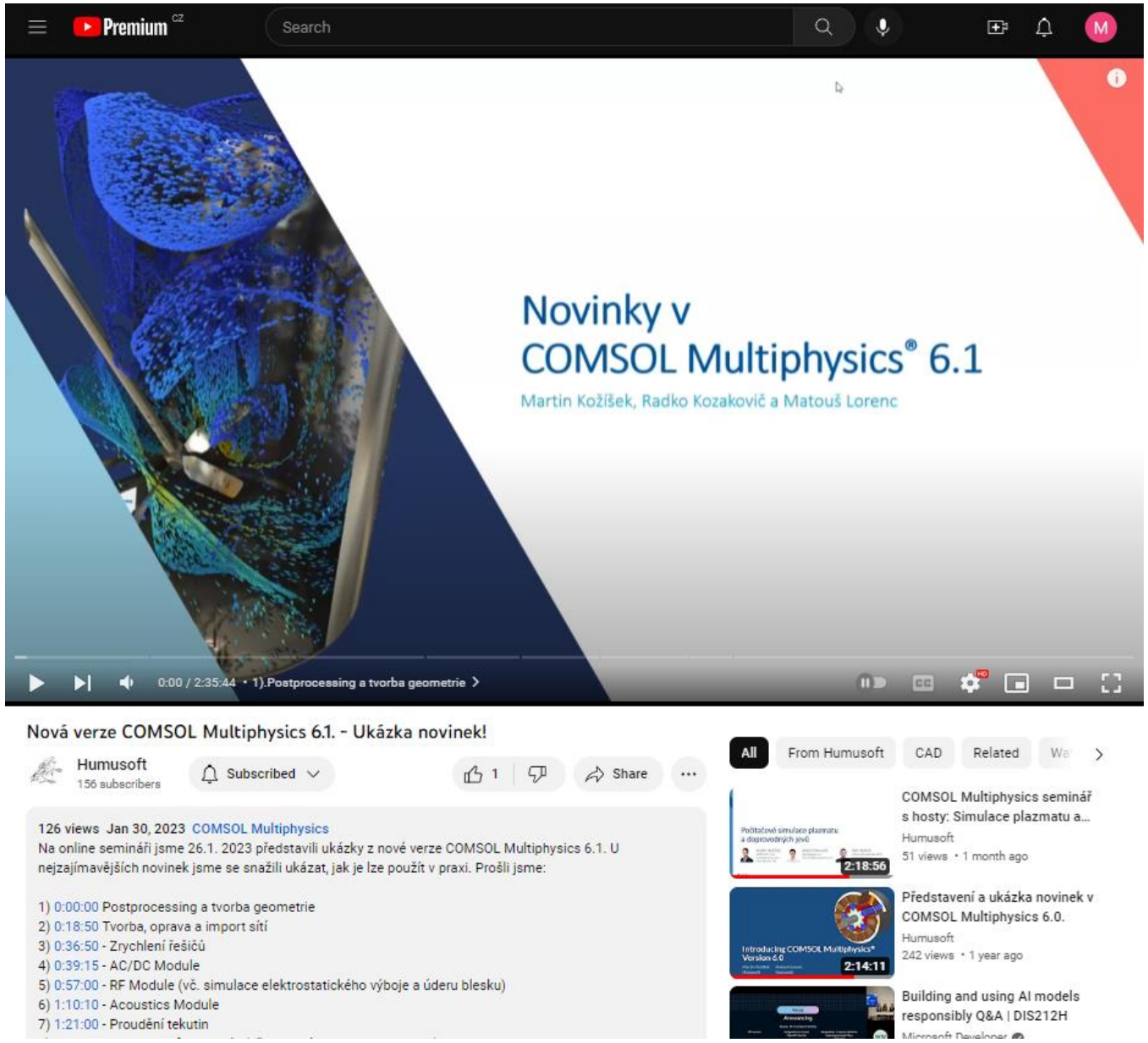
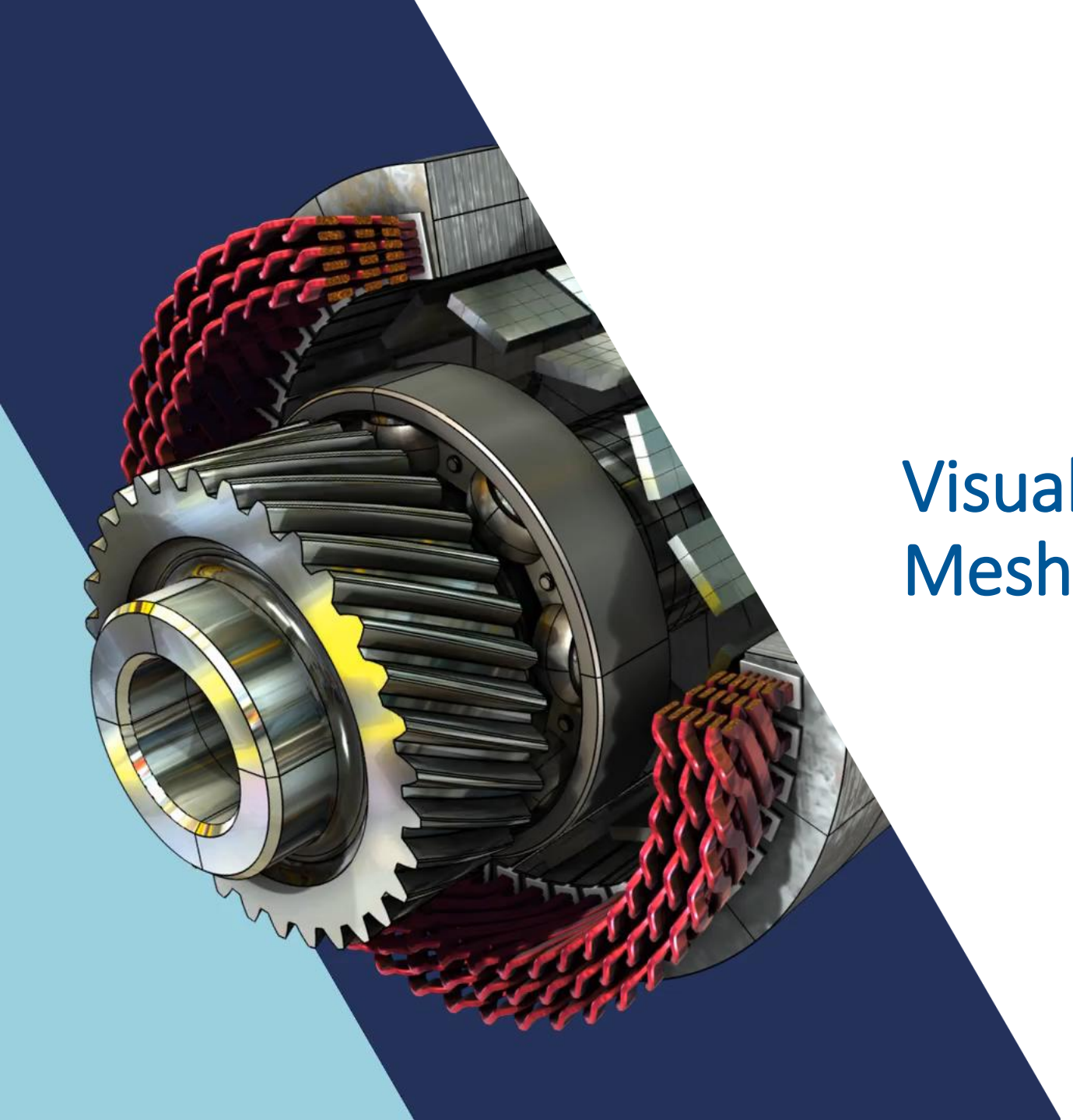
Twenty minutes never enough!

- Watch our full 3 hours webinar about news in version 6.1.
- https://youtube.com/@Humusoft



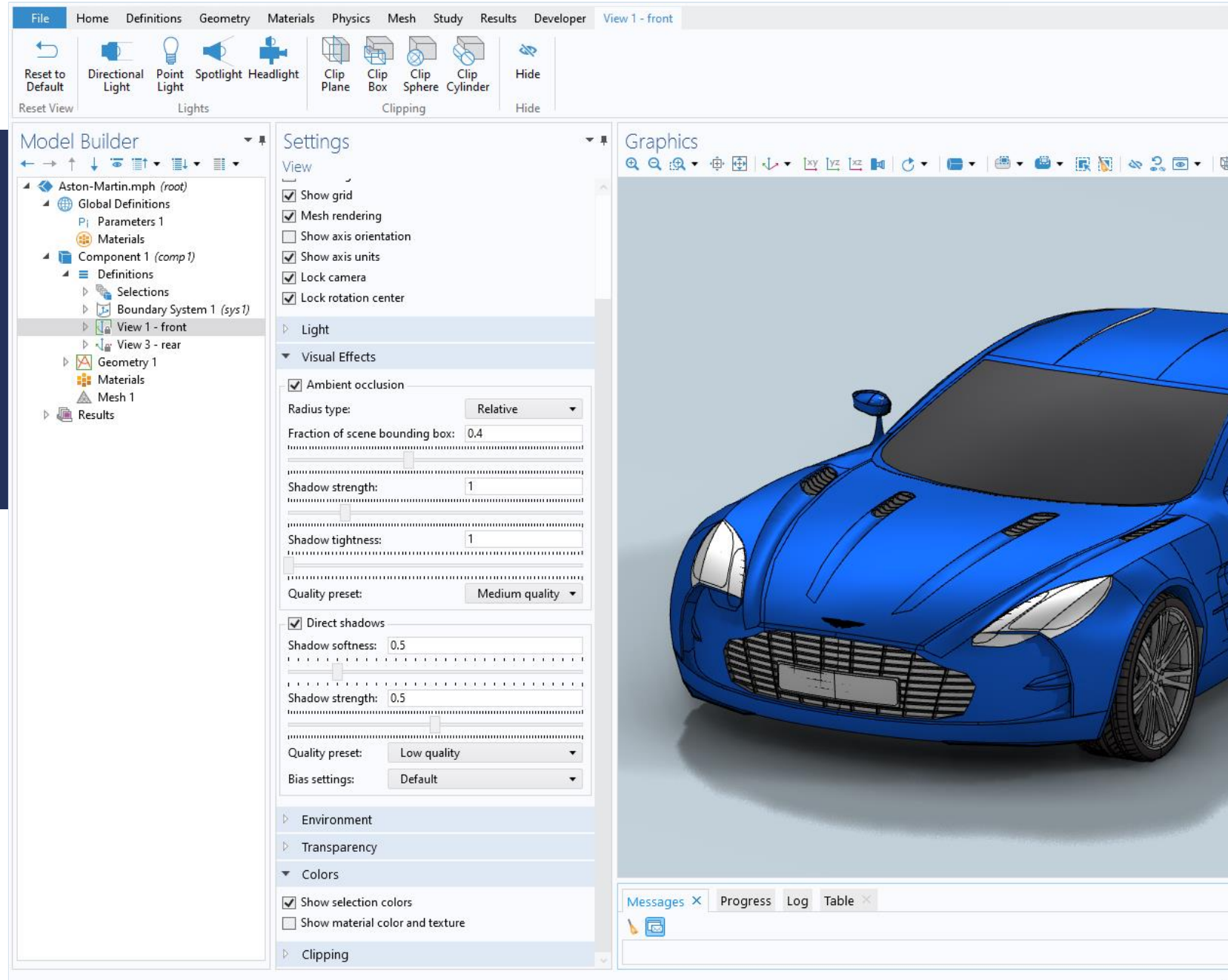
https://youtu.be/vLAcvkxwgxY



Visualization, Geometry, and Meshing News in 6.1

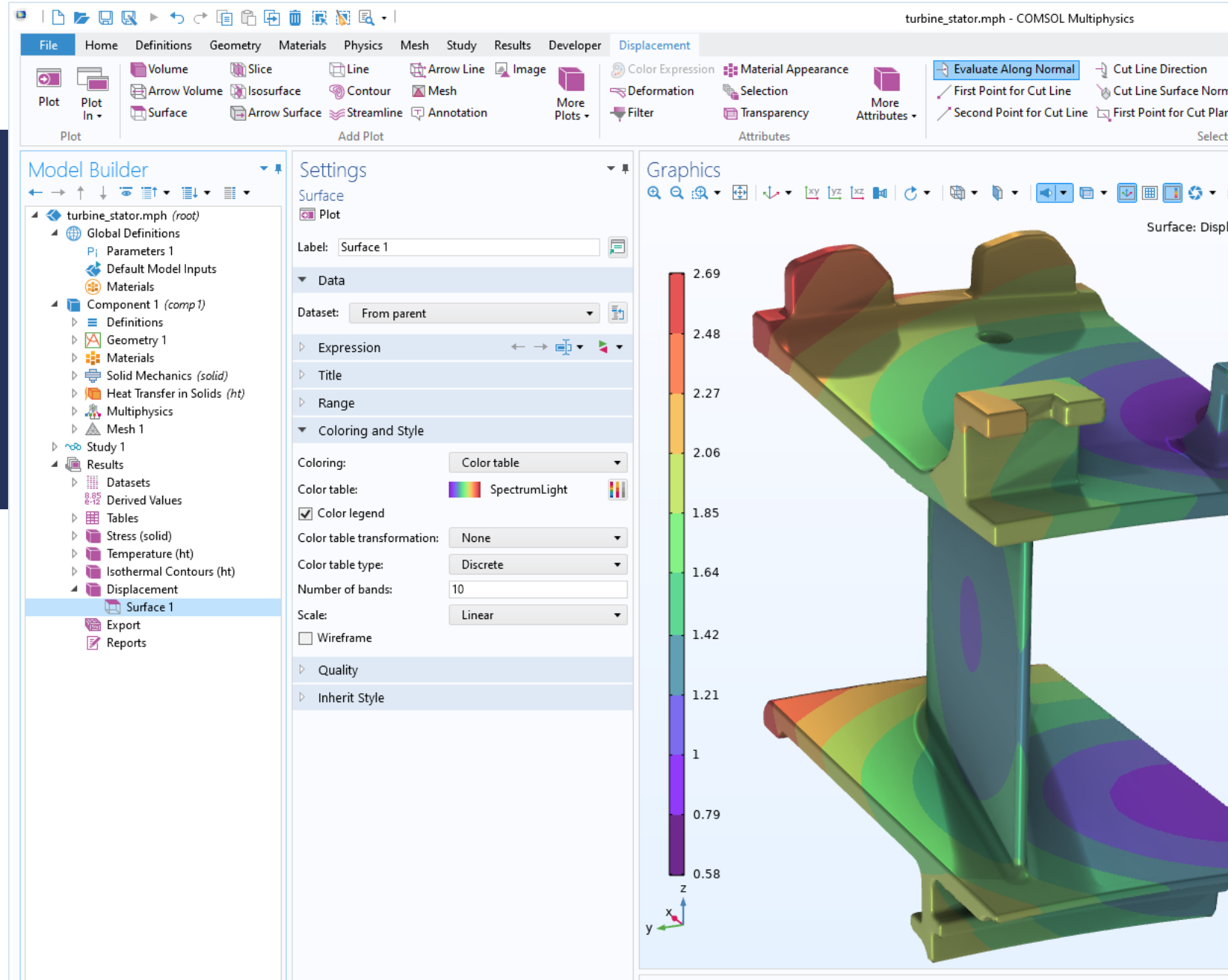
Visualization with Direct Shadows

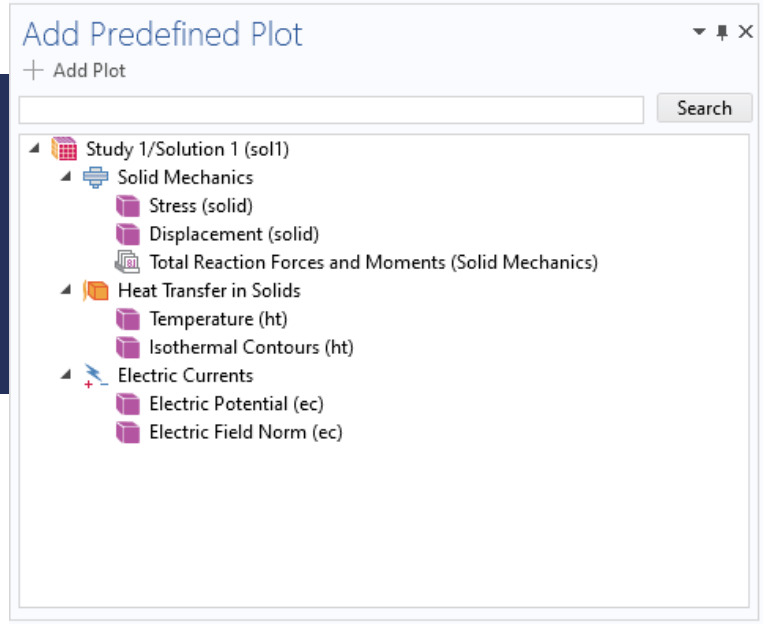
Improves depth perception by simulating shadows

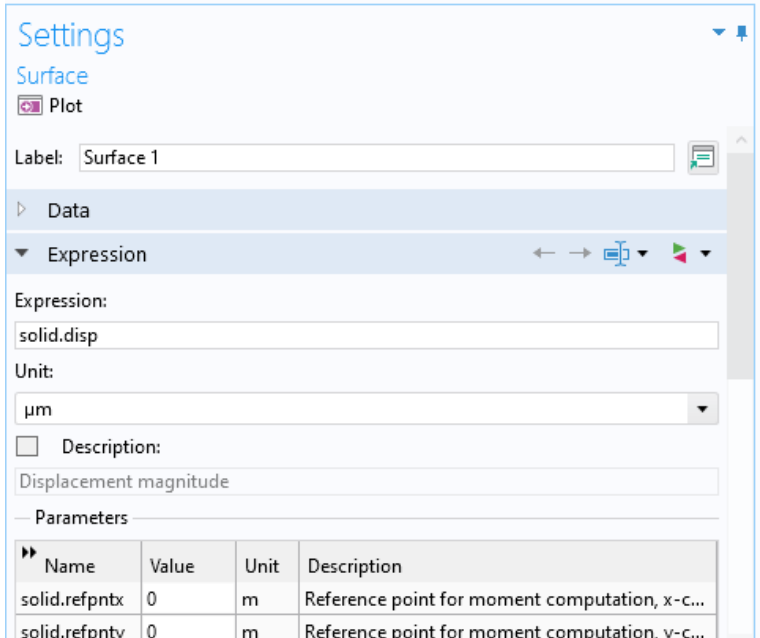


Discrete Color Legend

New discrete color table type is available for all plots that use color tables. This can make it easier to interpret visualizations of field variations.







Predefined Plots

- Plot group templates stored in the model but not added to the *Results* section
- Selected from the ribbon or the model tree
- Opens in its own desktop window
- Managed by physics interfaces

Untitled.mph - COMSOL Multiphysics

File Home Definitions Geometry Materials Physics Mesh Study Results Developer

Application Builder | Model Manager | Component 1 | Add Component | Parameters | Variables | Functions | Parameter Case | Build All | Import | LiveLink | Add Material | Select Physics Interface | Add Physics | Build Mesh | Mesh 1 | Compute | Select Study | Add Study | Select Plot Group | Add Plot Group | Add Predefined Plot | Windows | Reset Desktop

Workspace | Model | Definitions | Geometry | Materials | Physics | Mesh | Study | Results | Layout

Model Builder

- Untitled.mph *(root)*
  - Global Definitions
    - Parameters 1
    - Materials
  - Component 1 *(comp 1)*
    - Definitions
      - Boundary System 1 *(sys 1)*
      - View 1
    - Geometry 1
      - Import 1 *(imp 1)*
      - Form Union *(fin)*
    - Materials
    - Mesh 1
  - Results

Settings

Import

Build Selected | Build All Objects

Label: Import 1

Import

Source: COMSOL Multiphysics file

Filename: \\hay\ARCHIVE\USERS\kozisek\PROFILE\Desktop\Unt

Browse | Import

☑ Include result from virtual operations

Selections of Resulting Entities

☐ Resulting objects selection

Show in physics: Domain selection

Color: None

☐ Individual object selections

Show in physics: Domain selection

Cumulative selection

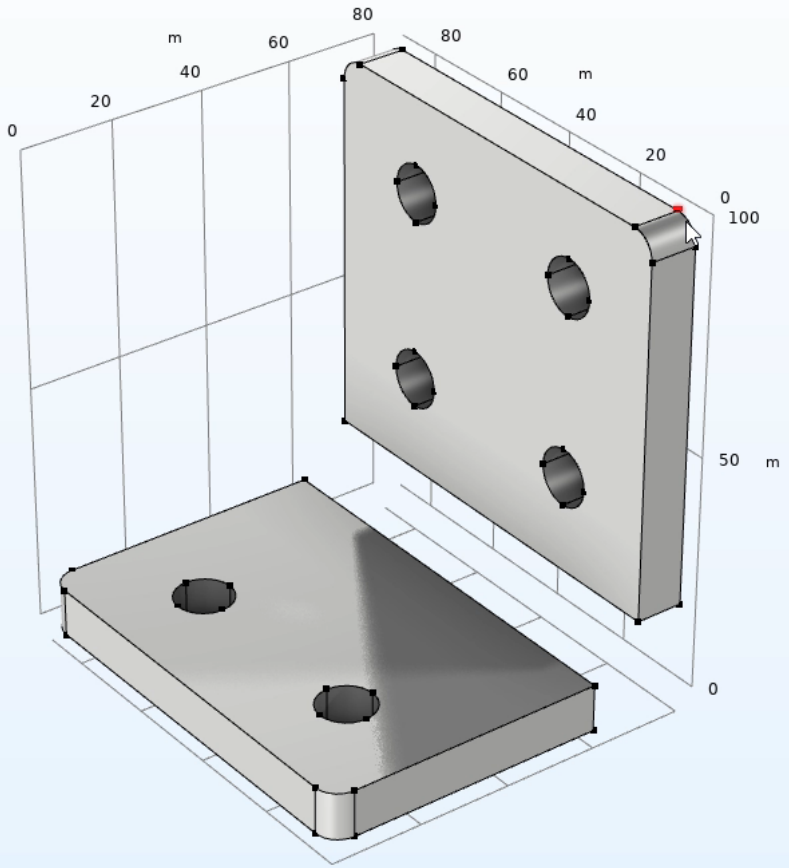
Contribute to: None | New

Assigned Attributes

☐ Construction geometry

Graphics

→ imp1 | 53

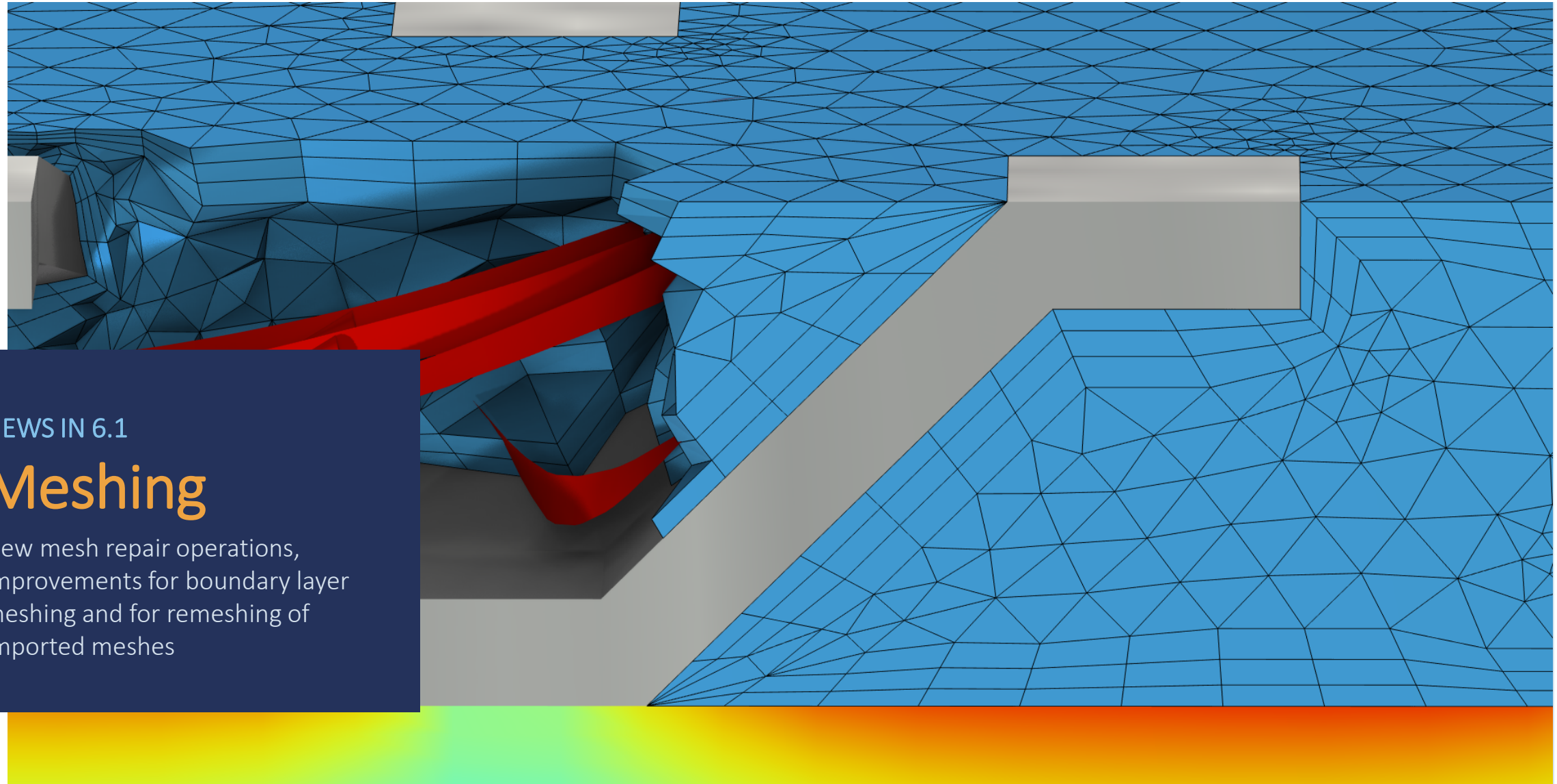


Messages | Progress | Log | Table

[Jan 21, 2023, 5:38 PM] Finalized geometry is disconnected and has 2 components.

1.31 GB | 1.67 GB

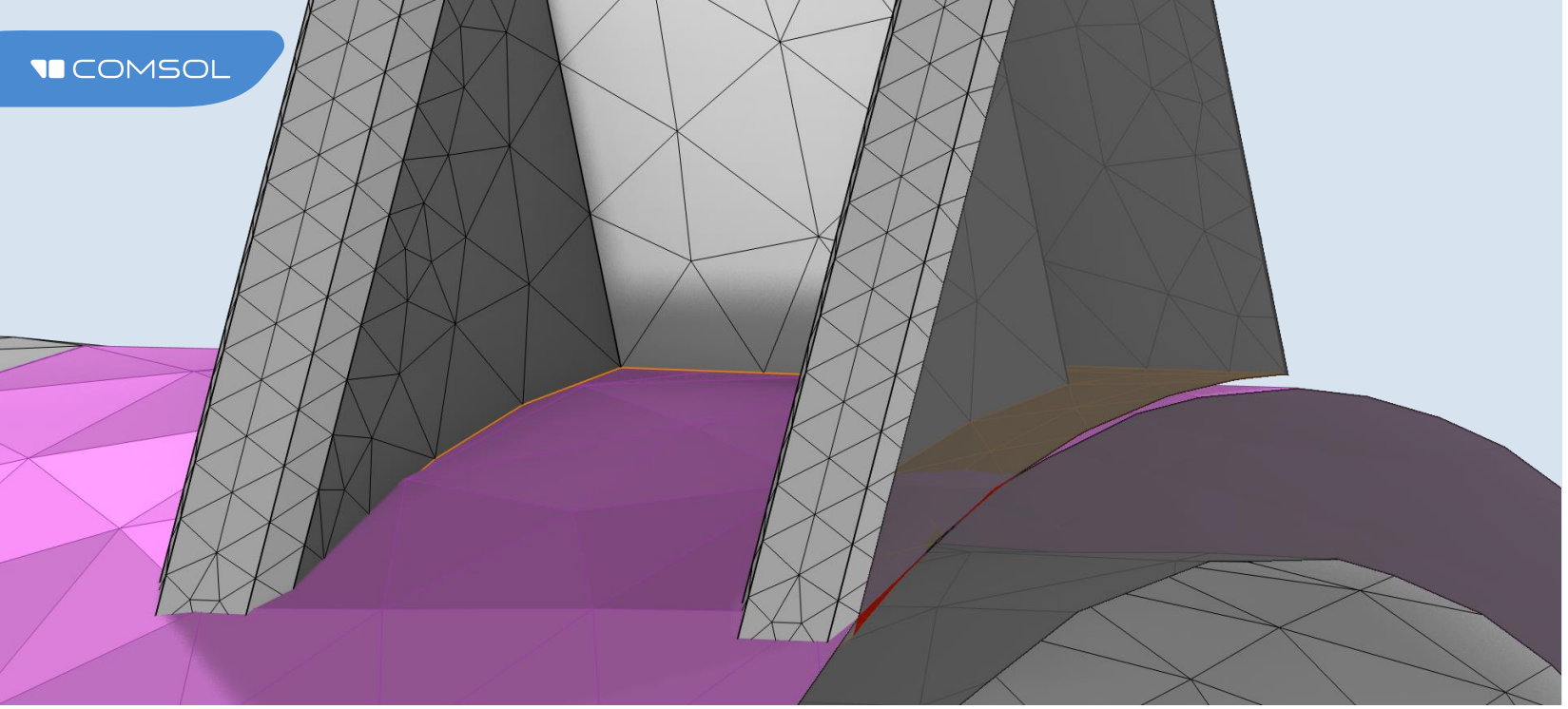
COMSOL

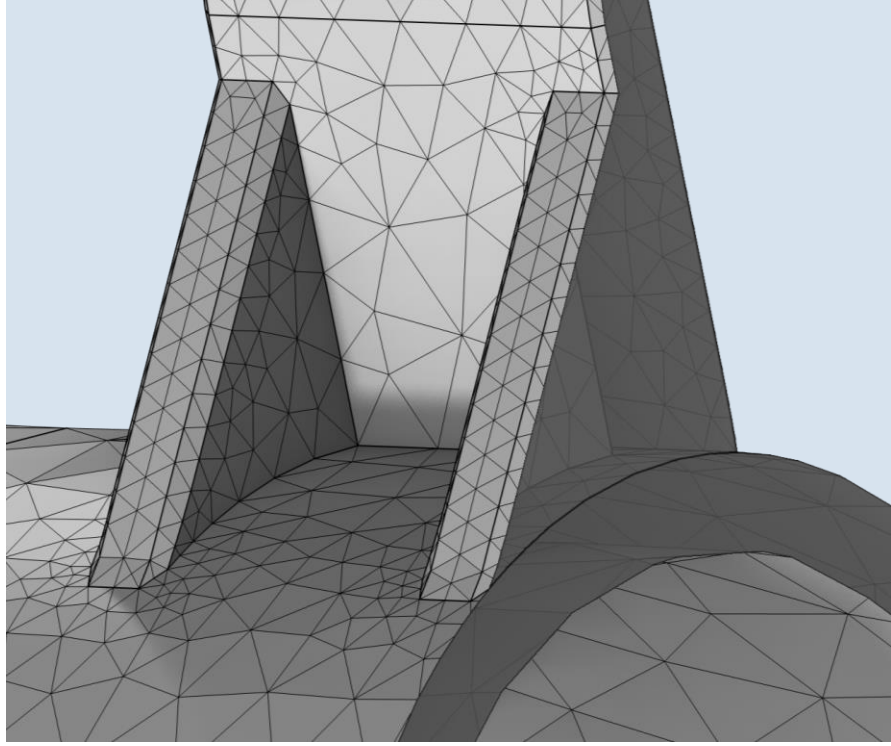


NEWS IN 6.1

Meshing

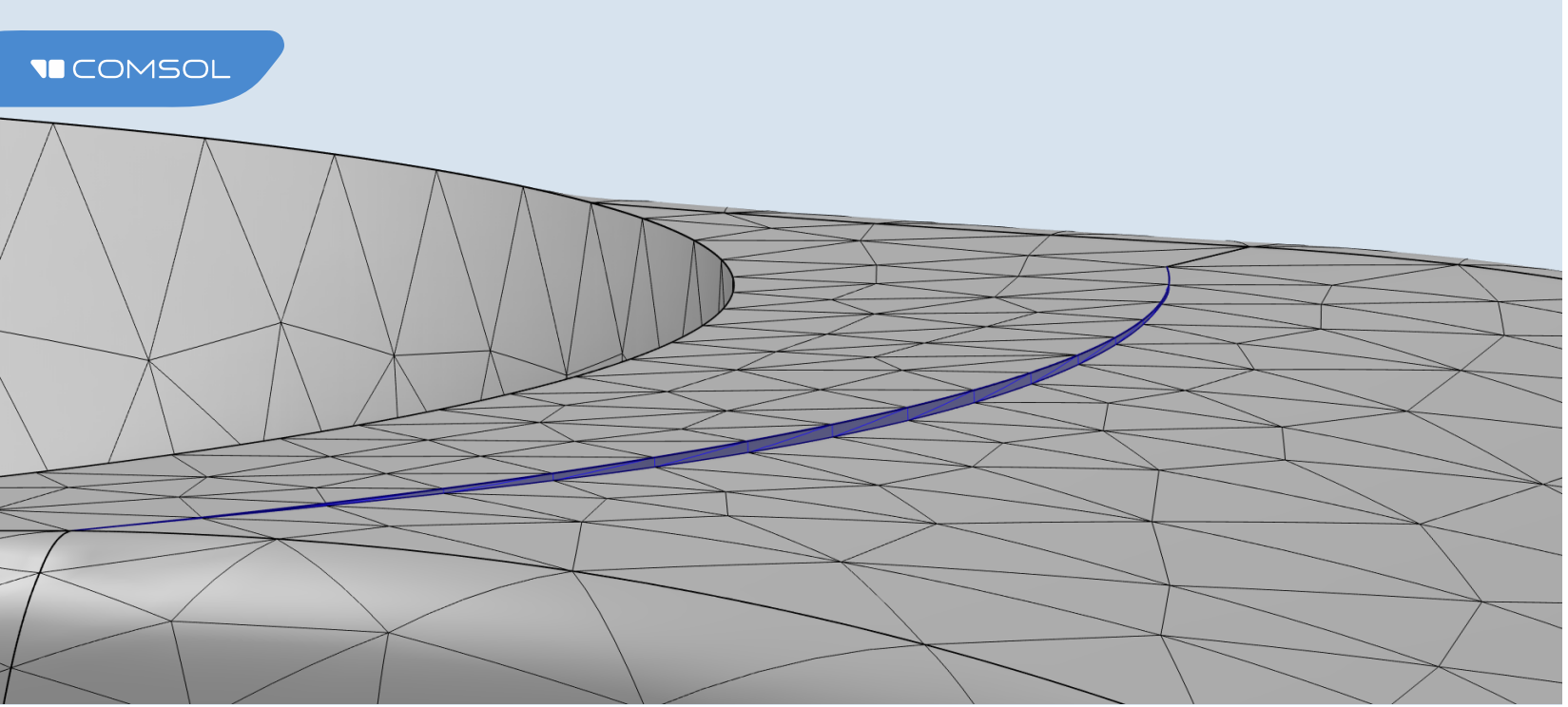
New mesh repair operations, improvements for boundary layer meshing and for remeshing of imported meshes

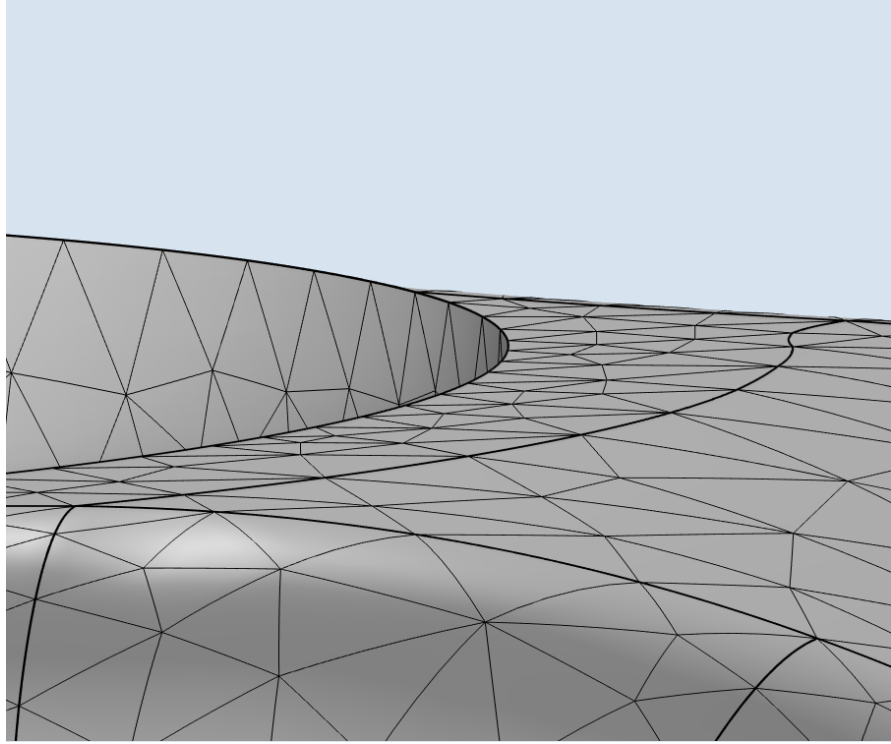




Repairing Meshes

- Provides an alternative to geometry repair for misaligned CAD models
- Merge of nearby faces, edges, or vertices in meshes for easier meshing



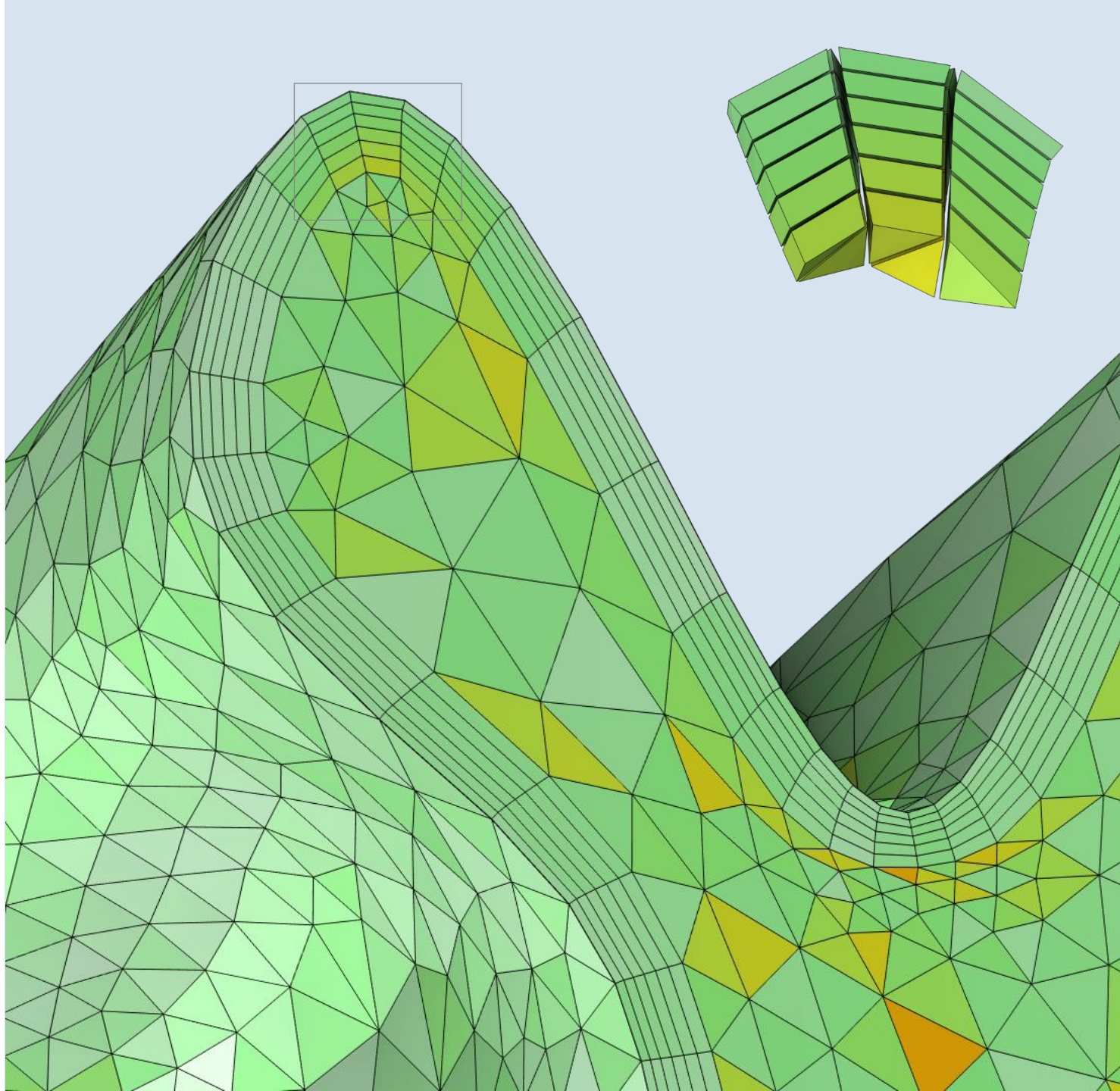


Collapse Entities in Meshes

- New operation to remove small edges and faces in meshes by collapsing them
- Finds and collapses entities smaller than an automatically determined entity size
- Simplifies remeshing of imported meshes

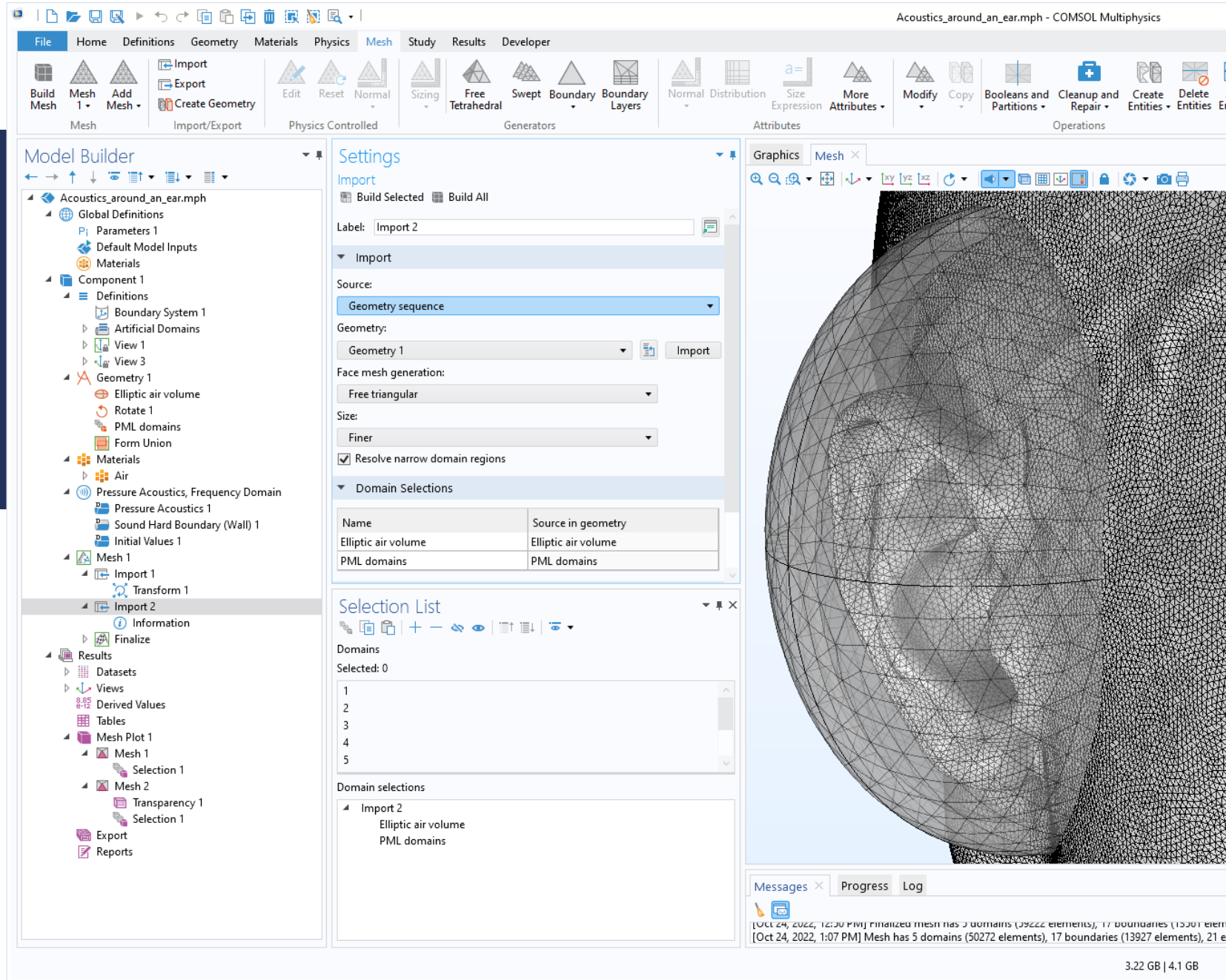
Boundary Layer Meshing Improvements

- Automatic adjustment of element directions away from the wall, especially useful for concave- and convex-shaped boundaries
- Improves the quality, which speeds up convergence and increases accuracy
- Option to turn off the adjustment, resulting in constant directions through all layers

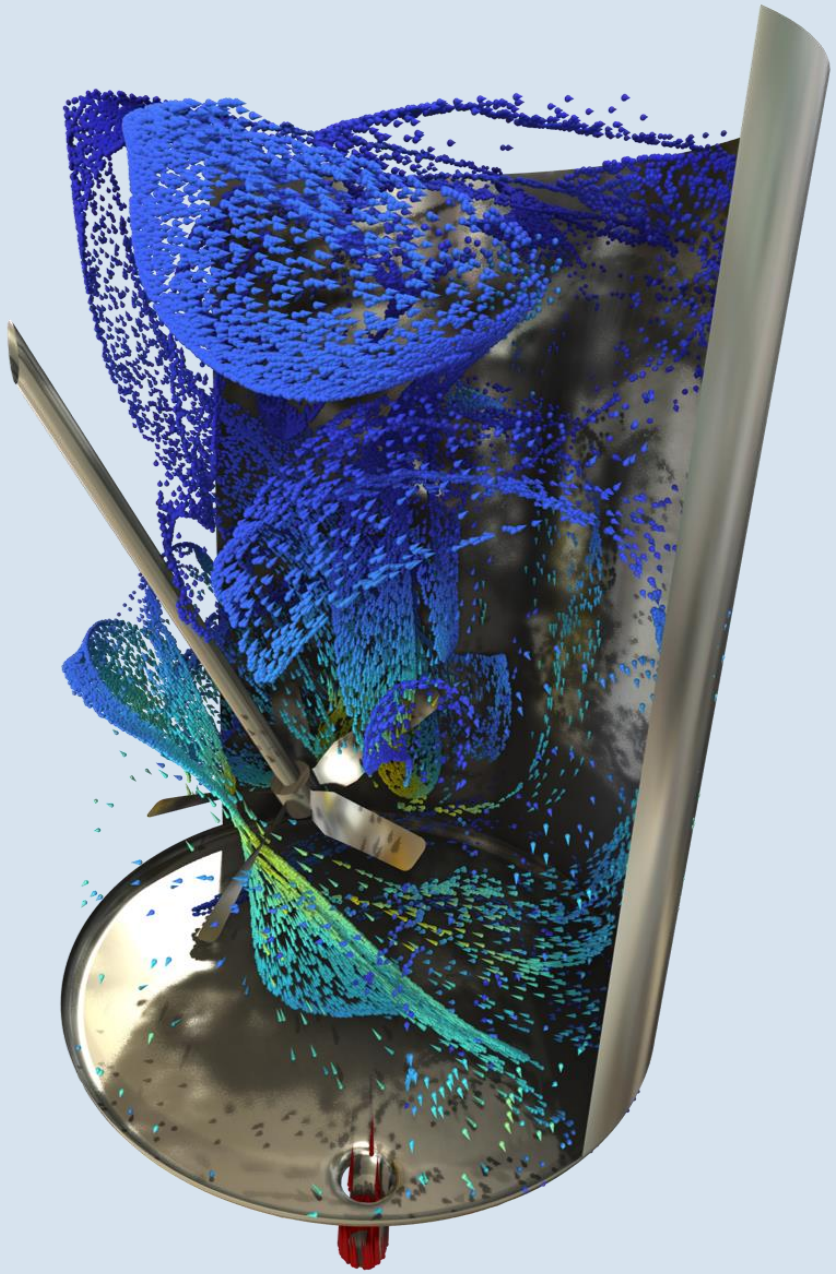


Combining Geometry and Mesh

The *Import* operation now makes it easier to combine a geometry model with an imported mesh. Named selections are automatically transferred for use in the meshing sequence.



Solver Performence in 6.1



Solvers

Solver Performance

- Up to 30% faster solvers for CFD
- Elastic–acoustic waves: 40% faster and larger models, > 2 billion DOFs

Uncertainty Quantification (UQ)

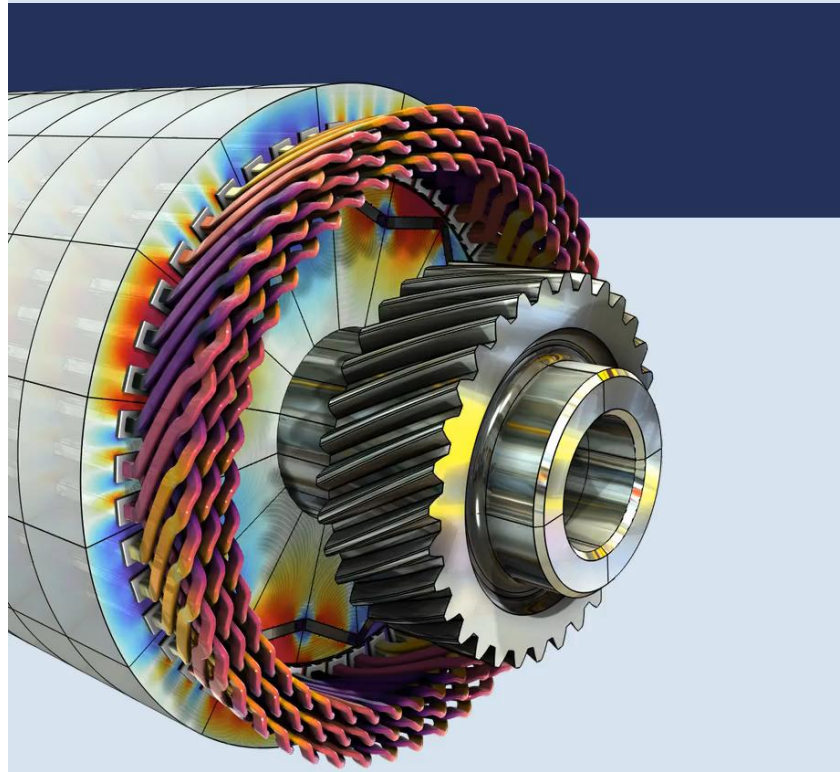
- Use experimental data for calibrating input uncertainty
- Multidimensional interpolation functions based on Gaussian process regression (Kriging)

AC/DC Module 6.1

AC/DC MODULE

Electrical Machines

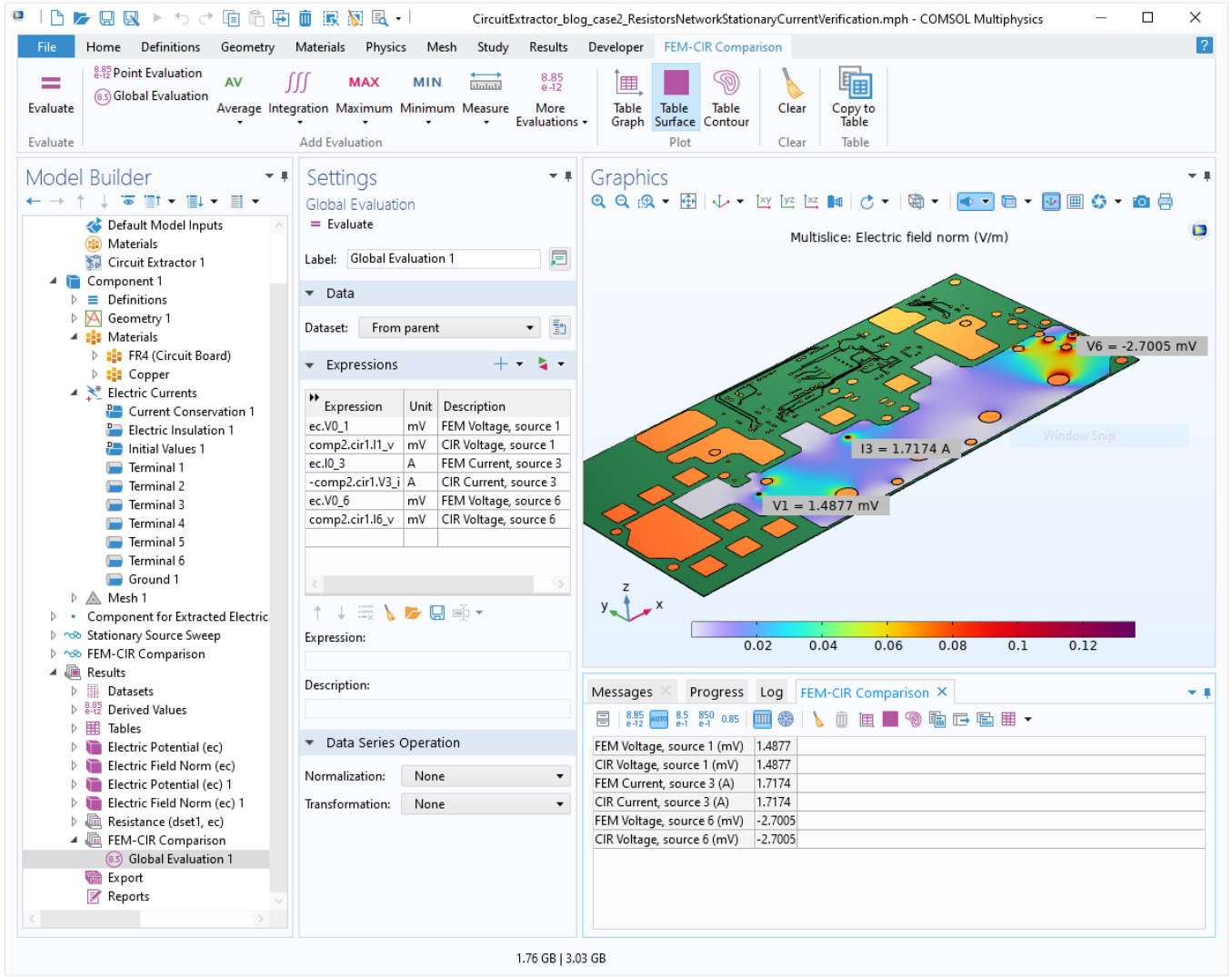
- *Magnet* domain feature
  - Magnetization direction
  - Interior insulation boundaries
  - Magnet arrays
- *Winding Layout* feature
  - Specify winding pattern, 2D
- Coil wire cross section from *Slot Filling Factor*
- Improved *Sector Symmetry*
- New and enhanced examples and tutorial models



AC/DC MODULE

Circuit Extraction

- *Circuit Extractor* add-in
- Lumped matrix output from source sweep studies
  - EC, ES, and ESBE (stationary)
  - MEF and MFCO (stationary and frequency domain)
- *Passive Conductor* feature for *Magnetic Fields, Currents Only*
- Enhanced postprocessing



AC/DC MODULE

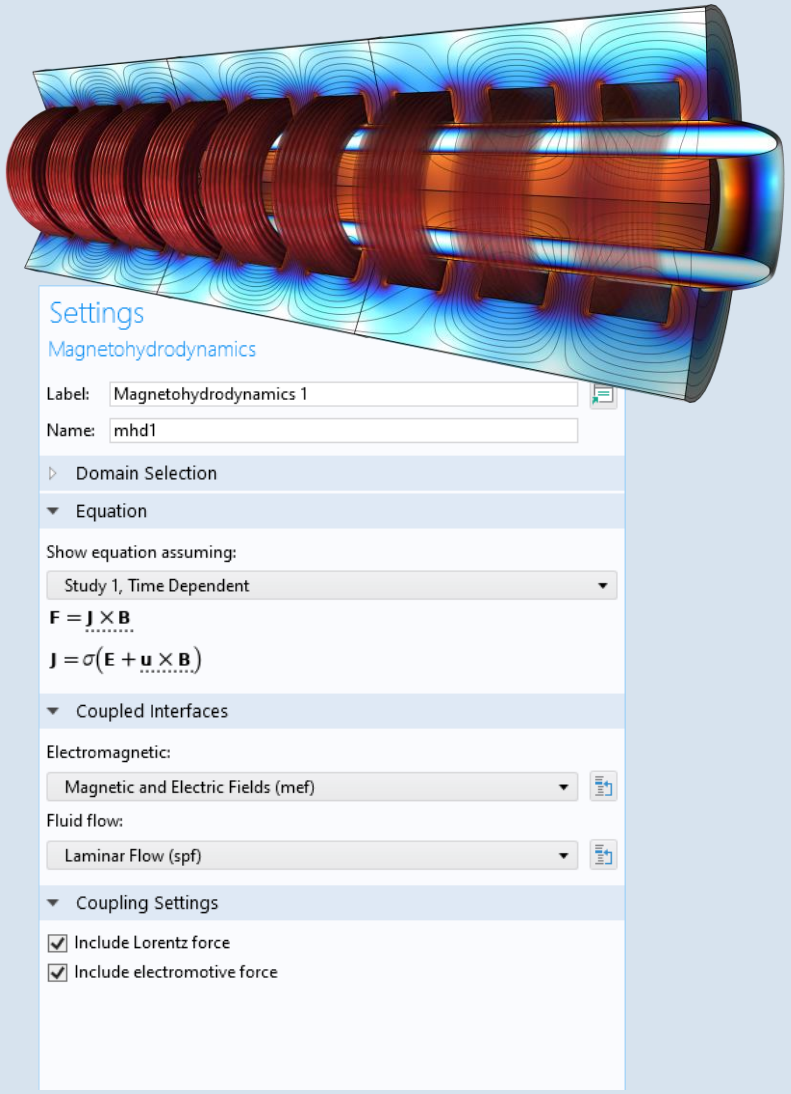
Magnetohydrodynamics

New *Magnetohydrodynamics* multiphysics interface

- Interaction between electromagnetics and fluid flow
- Conserves electrical currents
- New *Liquid Metal* material library

Extended *Magnetic and Electric Fields* interface

- Transient study is now available
- Supports both gauged and ungauged formulations
- Efficient iterative solver with hybrid preconditioners



RF Module 6.1

RF MODULE

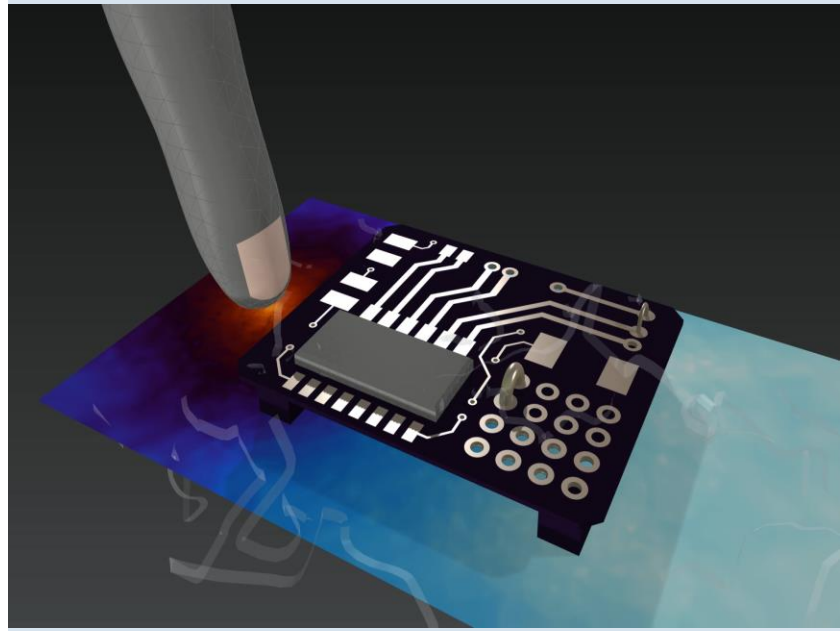
Lightning and Electrostatic Discharge (ESD)

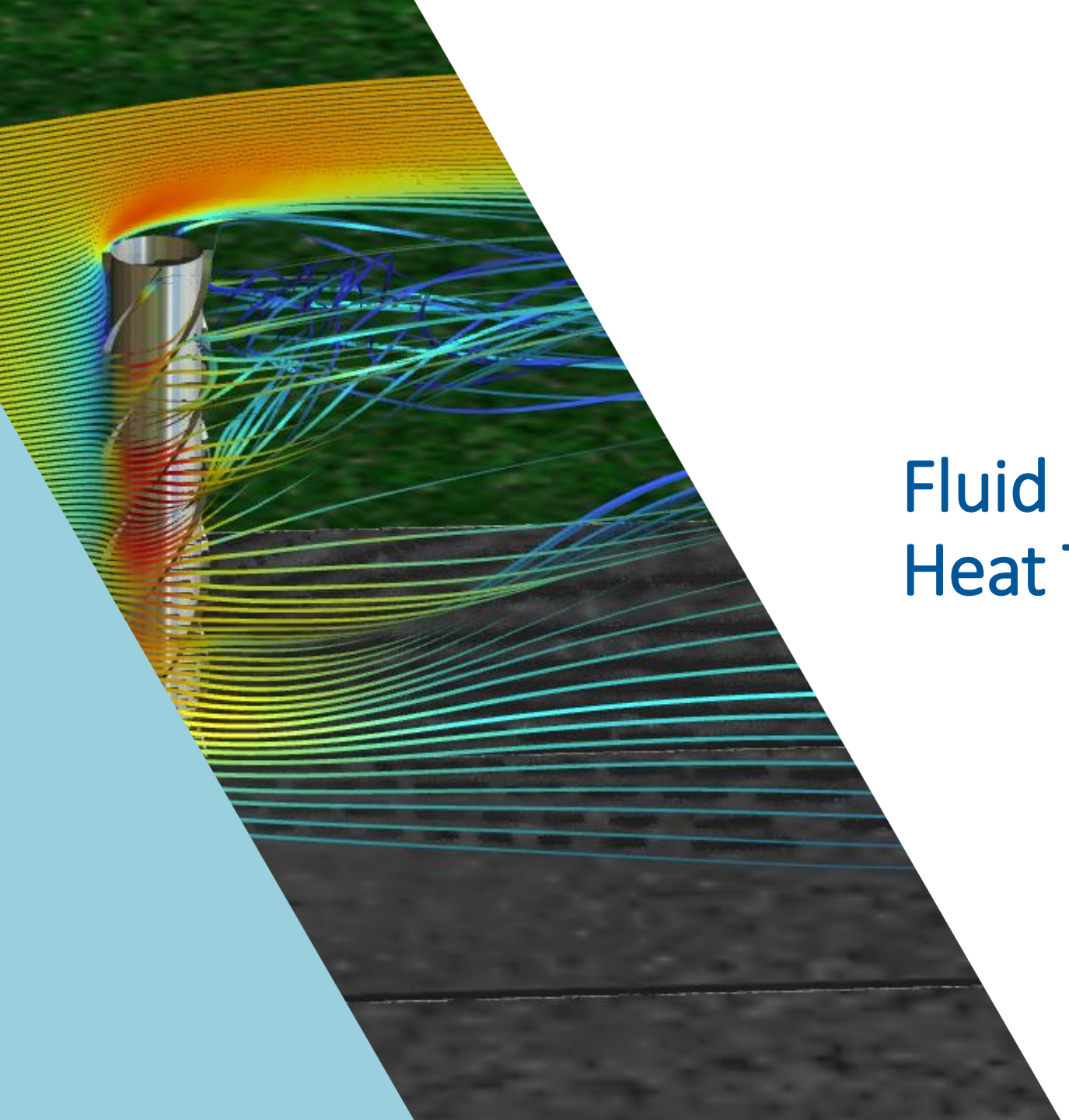
Predefined adjustable ESD models

- Human body
- Extended human body
- Machine
- Charged device

Pulses for electrostatic discharge and lightning

- Transient lumped port
- Transient edge current
- Fully parameterized to customize the pulse shape



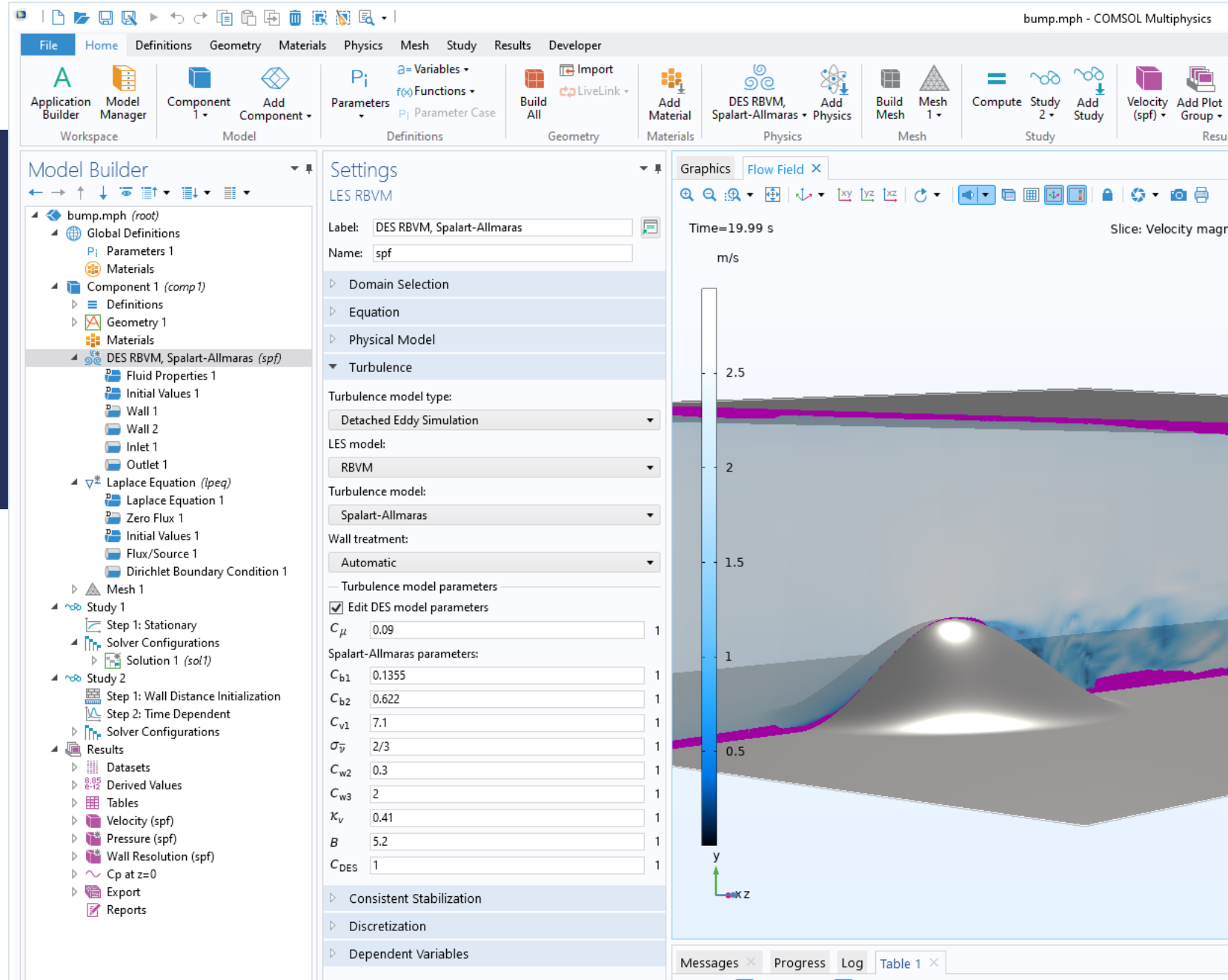


Fluid Flow & Heat Transfer in 6.1.

Detached Eddy Simulation (DES)

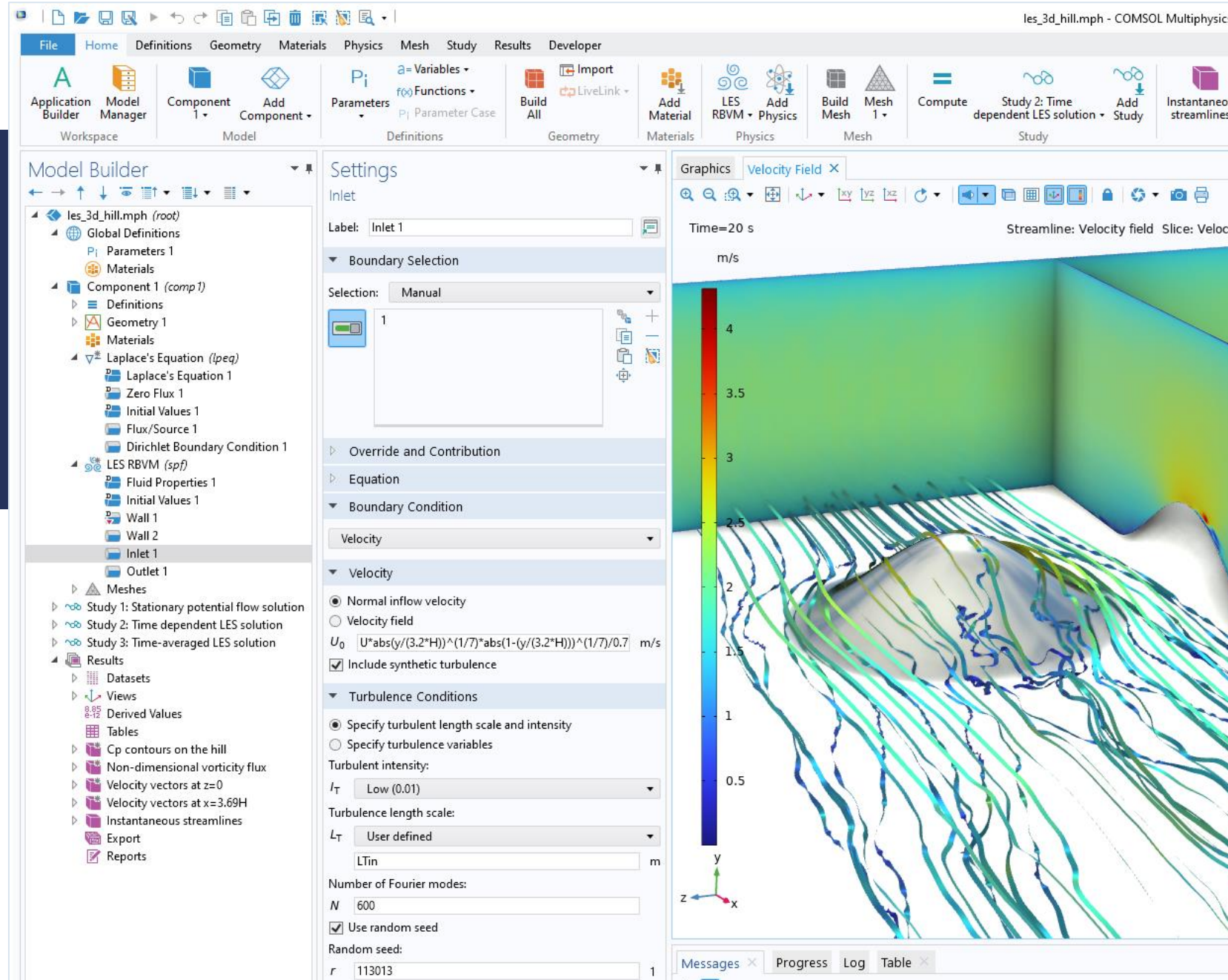
- Combines the accuracy of LES* with the performance of RANS** models by using less dense mesh with RANS close to the walls
- Gives high accuracy at relatively low computational cost for flows around bluff bodies or with separation from sharp edges

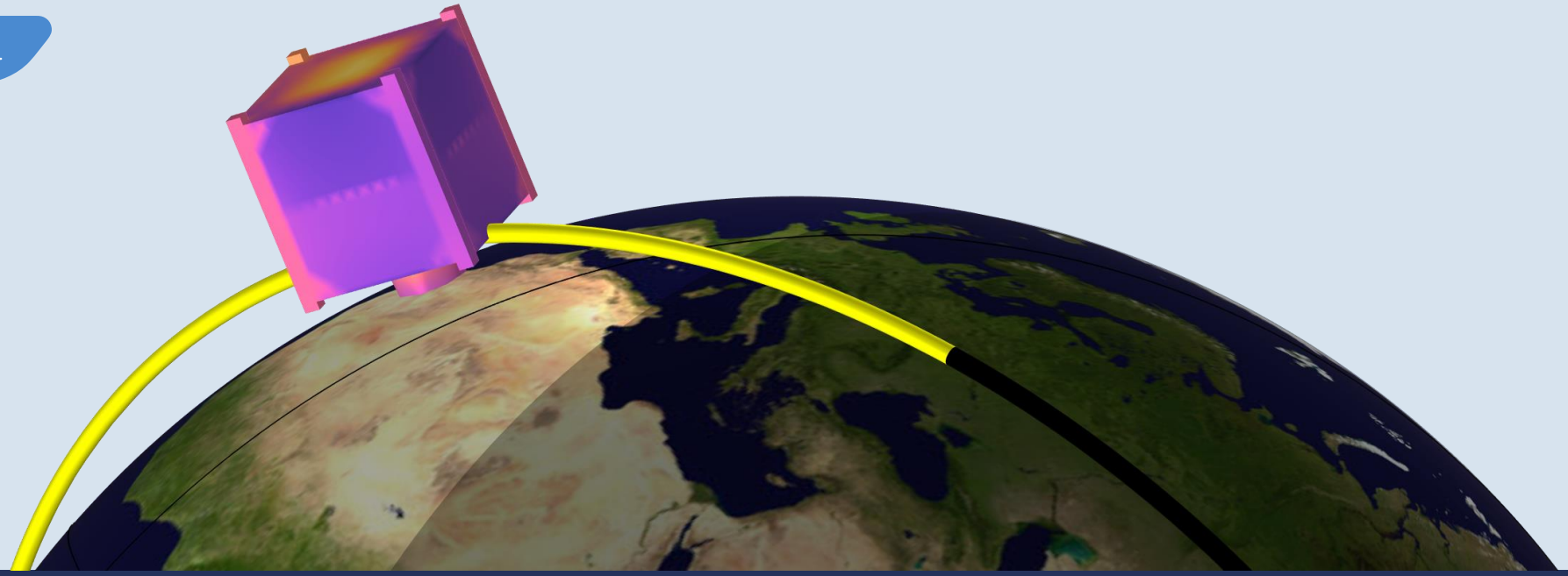
*LES = Large eddy simulation
**RANS = Reynolds-averaged Navier–Stokes (turbulence models)



Realistic Inlets for LES

- Random velocity fluctuations in space and time
- Based on a truncated energy spectrum for homogeneous isotropic turbulence
- Includes time correlation
- Specify *k* and ε, or intensity and length scale, and the number of Fourier modes





The Orbital Thermal Loads Interface Computes Environmental Radiative Loads and Thermal Radiation

Orbital Modeling

Use the orbital and mission parameters to determine how the satellite is oriented relative to the Sun and Earth.

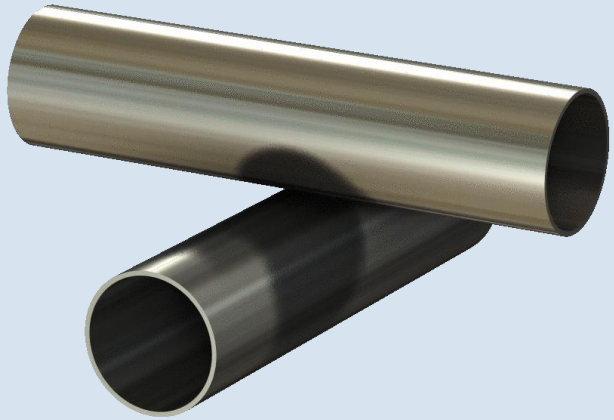
Radiative Environment

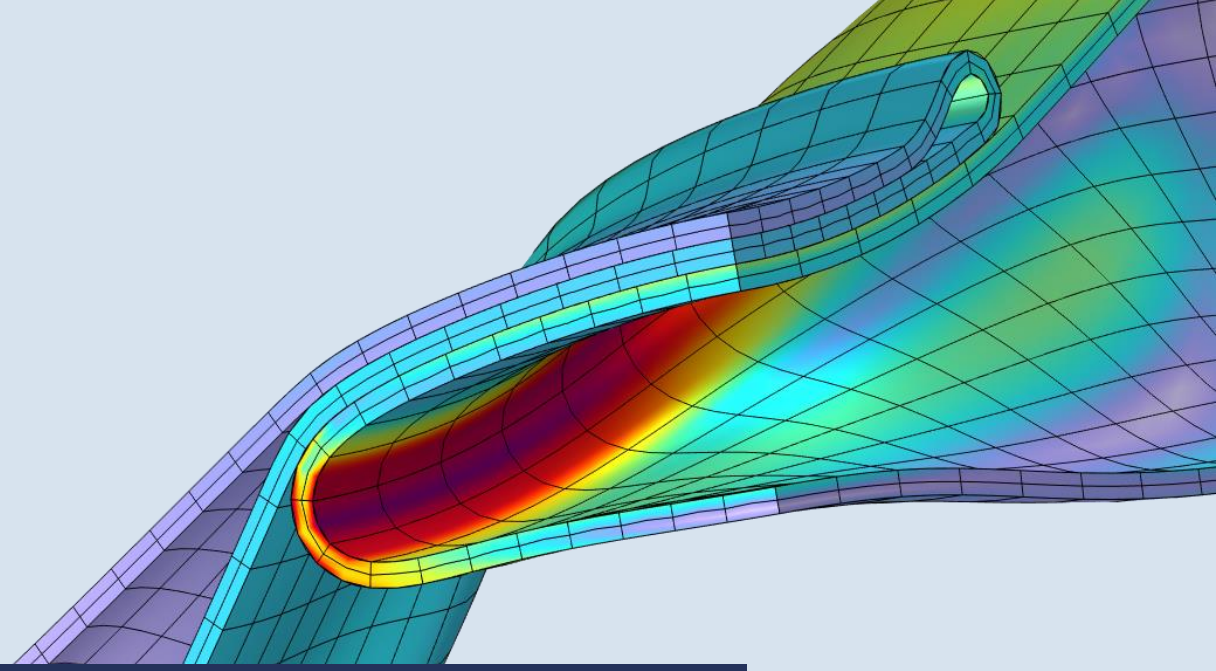
Using the satellite orientation, compute the incident solar, albedo, and Earth infrared (IR) loads.

Temperature Distribution over Time

Once the environmental loads are known, compute the satellite temperature and radiative heat exchange between surfaces and the surrounding space.

Structural Mechanics in 6.1





New Contact Formulations

Nitsche Formulation

More accurate than the penalty method; still no extra degrees of freedom (DOFs).

Faster Search Method

New algorithm for finding the source boundary.

New Formulations

Improved formulations for *Shell*, *Membrane*, and *Layered Shell* interfaces.

Reduced Jacobian improves stability.

Self-Contact

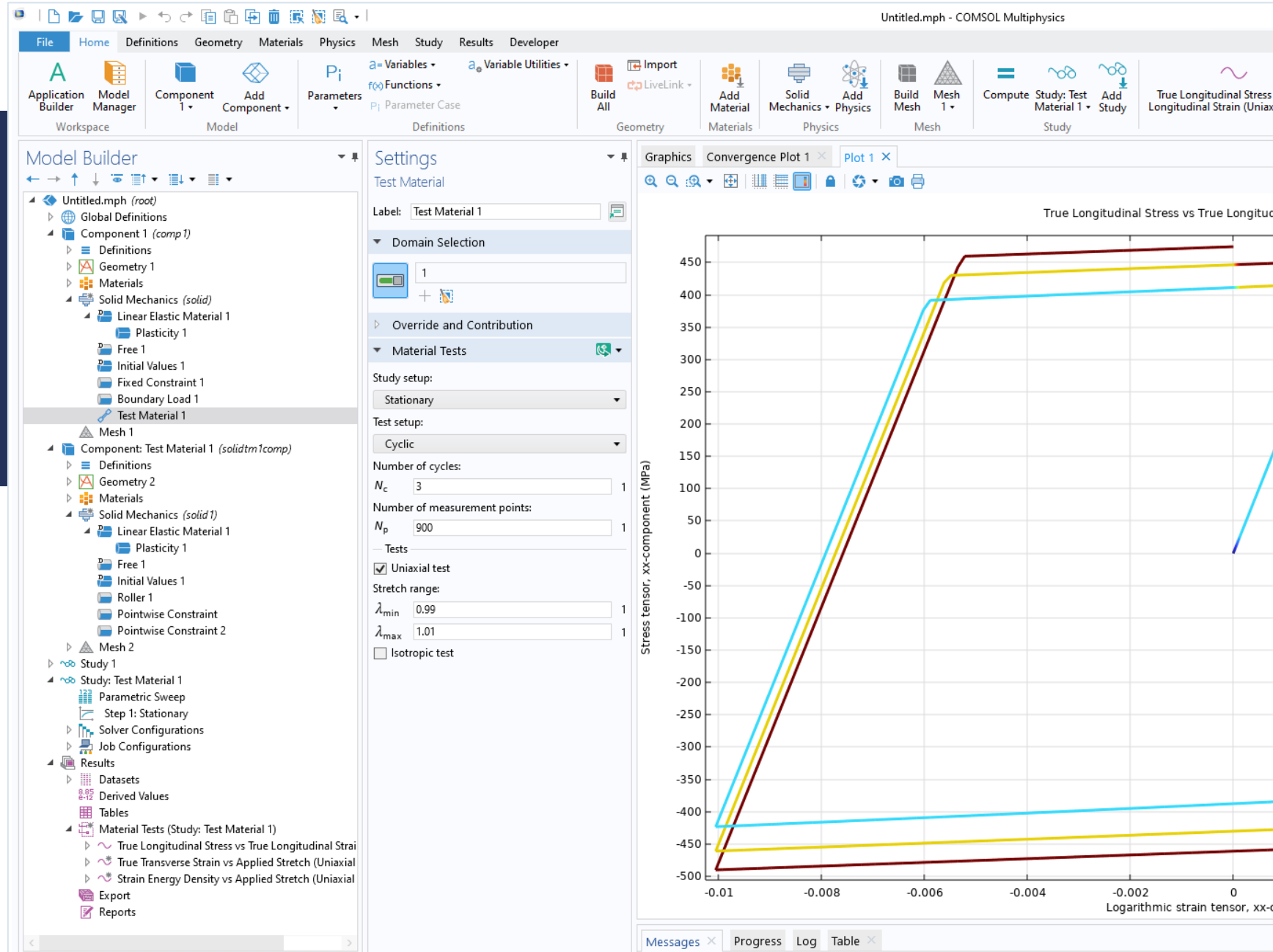
Self-contact is now fully supported.

Numerical Testing of Material Models

The *Test Material* feature provides automatic set up of numerical tests on a single element.

Test scenarios:

- Uniaxial, biaxial, triaxial, shear, isotropic, oedometer
- Monotonic or cyclic
- Stationary or time dependent



Topology Optimization

- The full wheel is modeled
- Sector symmetry imposed
- The wheel rim optimized for stiffness
- Optimization includes milling constraints in the axial direction