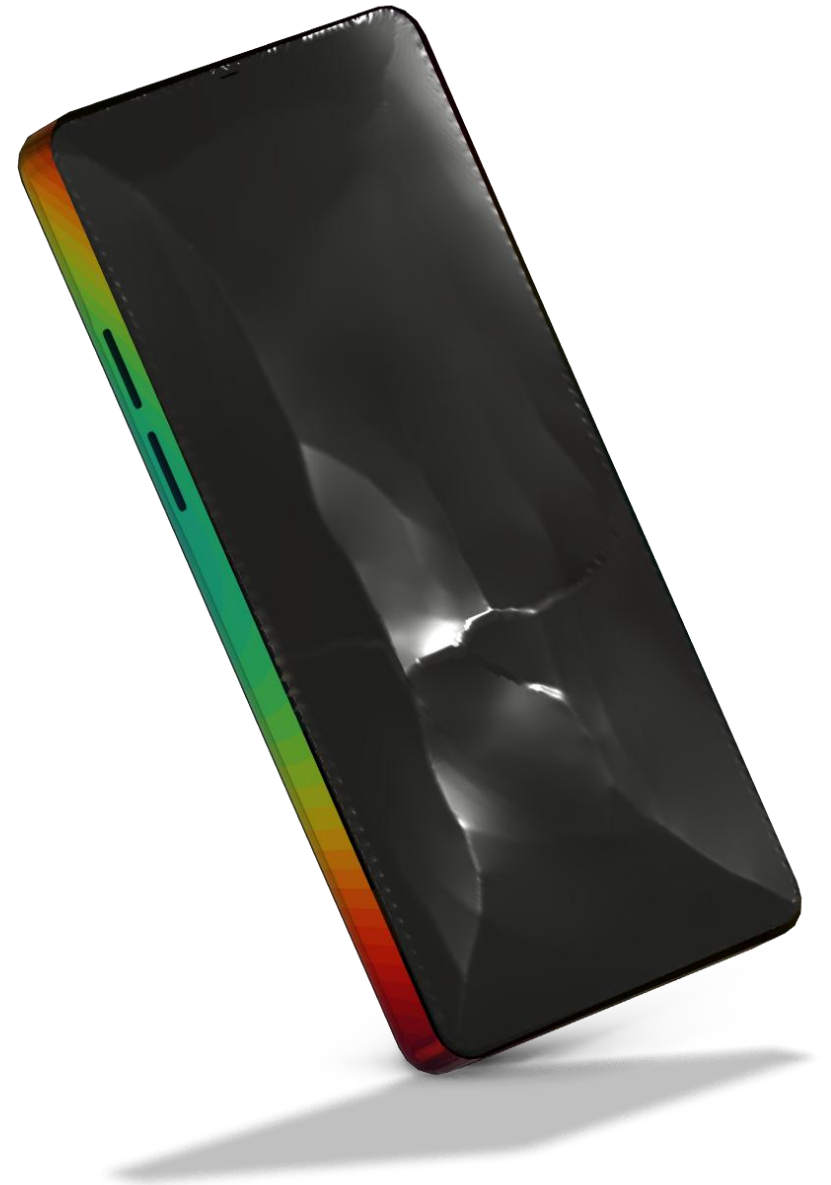


Introducing COMSOL Multiphysics® Version 6.4



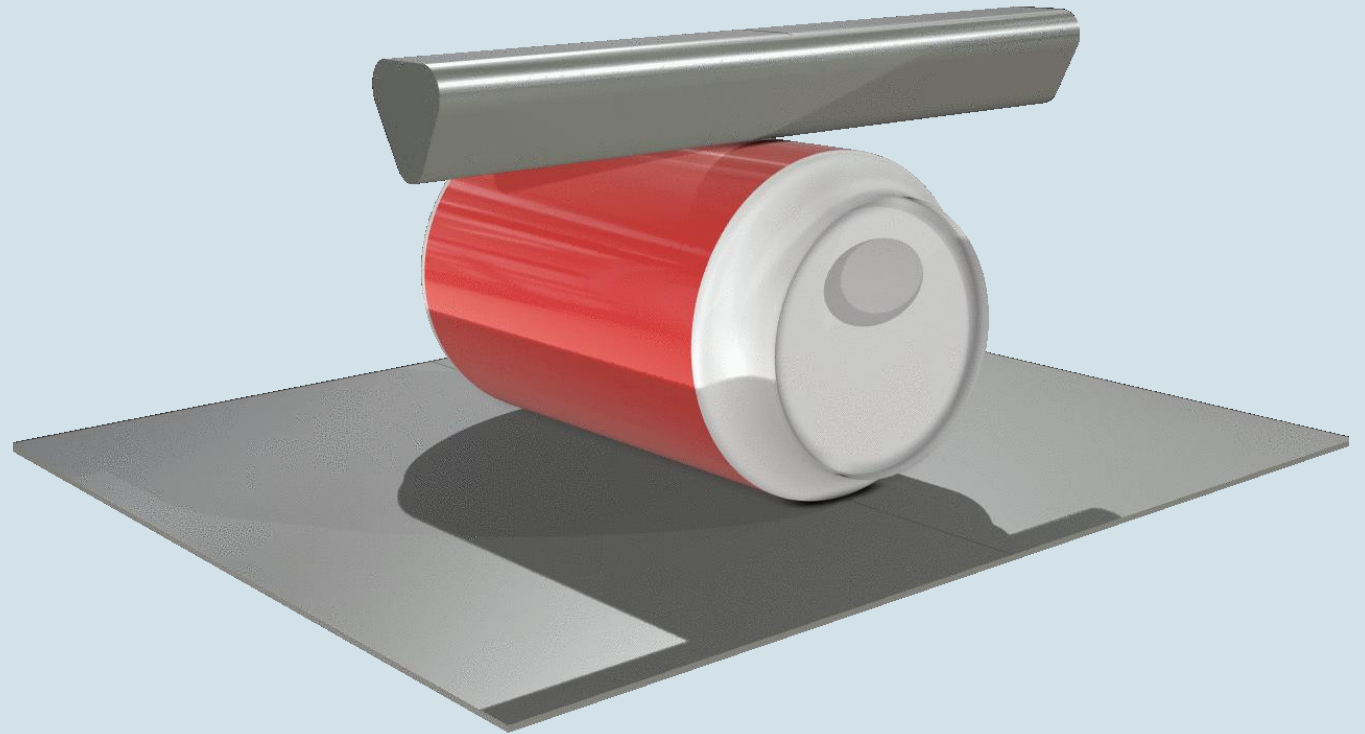
Martin Kožíšek
kozisek@humusoft.cz



MAJOR NEWS

Explicit Structural Dynamics

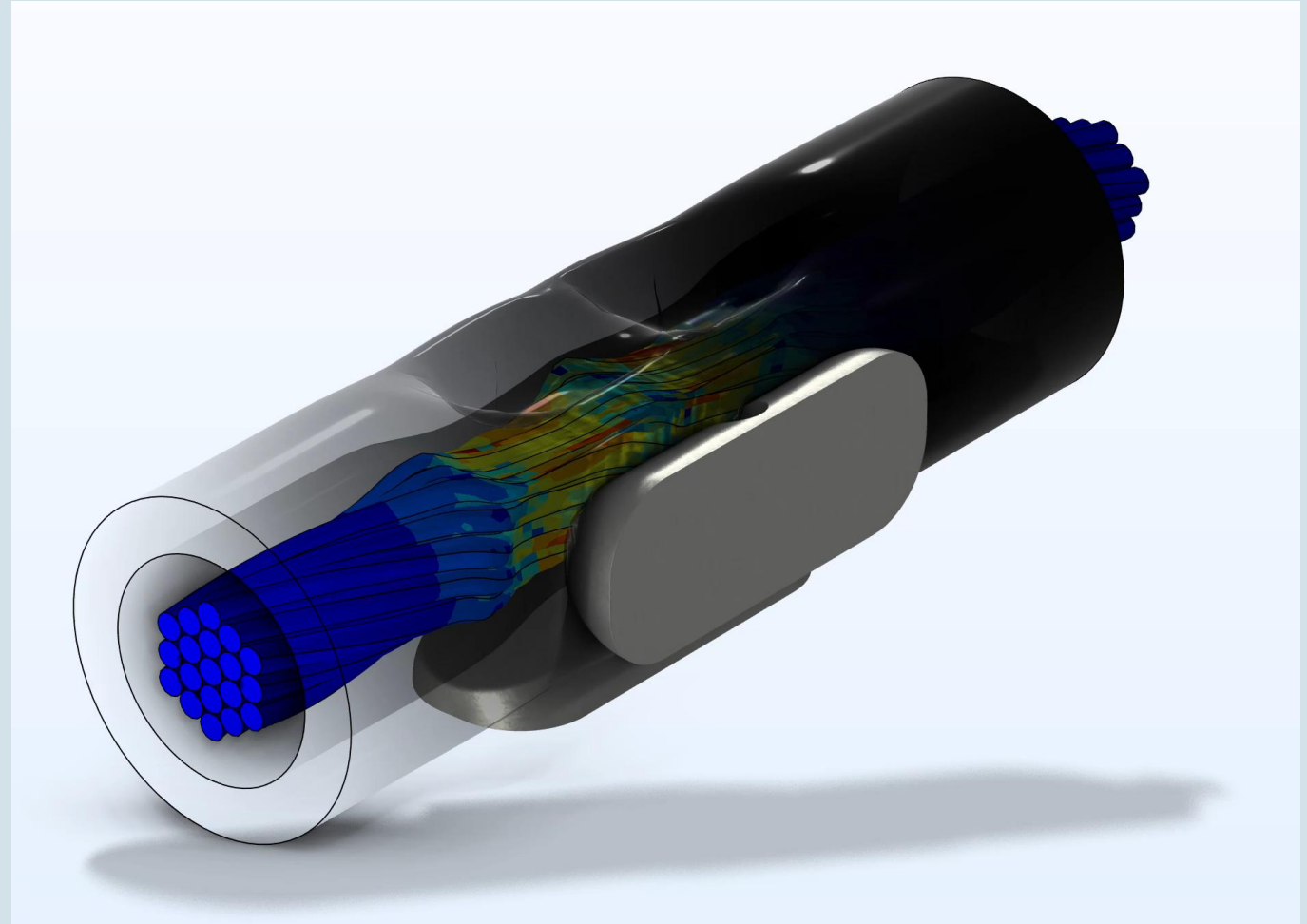
- High-speed events
- Support for many material models
- Applications:
 - Drop tests and impact analysis
 - Sheet metal forming
 - Ballistic impact problems



MAJOR NEWS

Explicit Structural Dynamics

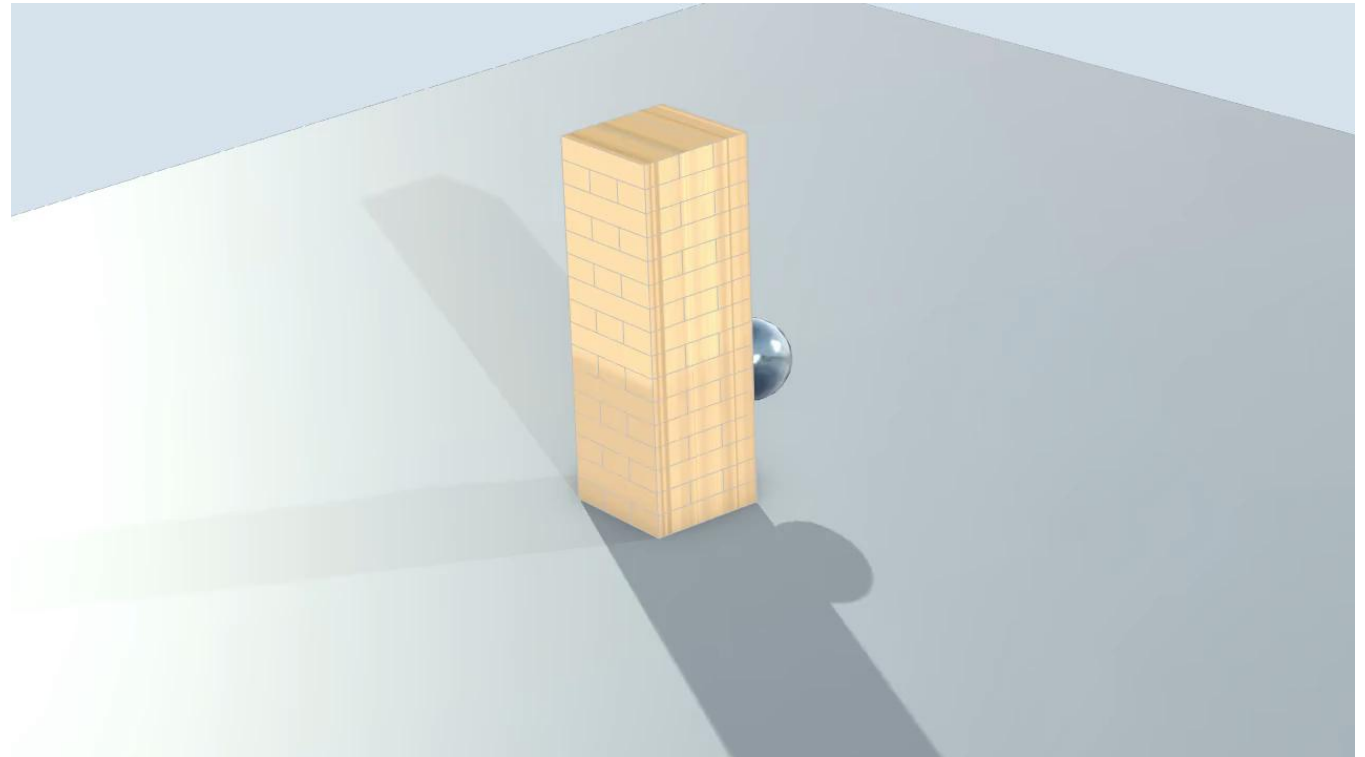
- High-speed events
- Support for many material models
- Applications:
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MAJOR NEWS

General Contact

- New pair type
- Automatic contact detection for multiple objects
- Self-contact
- Only Solid Mechanics*

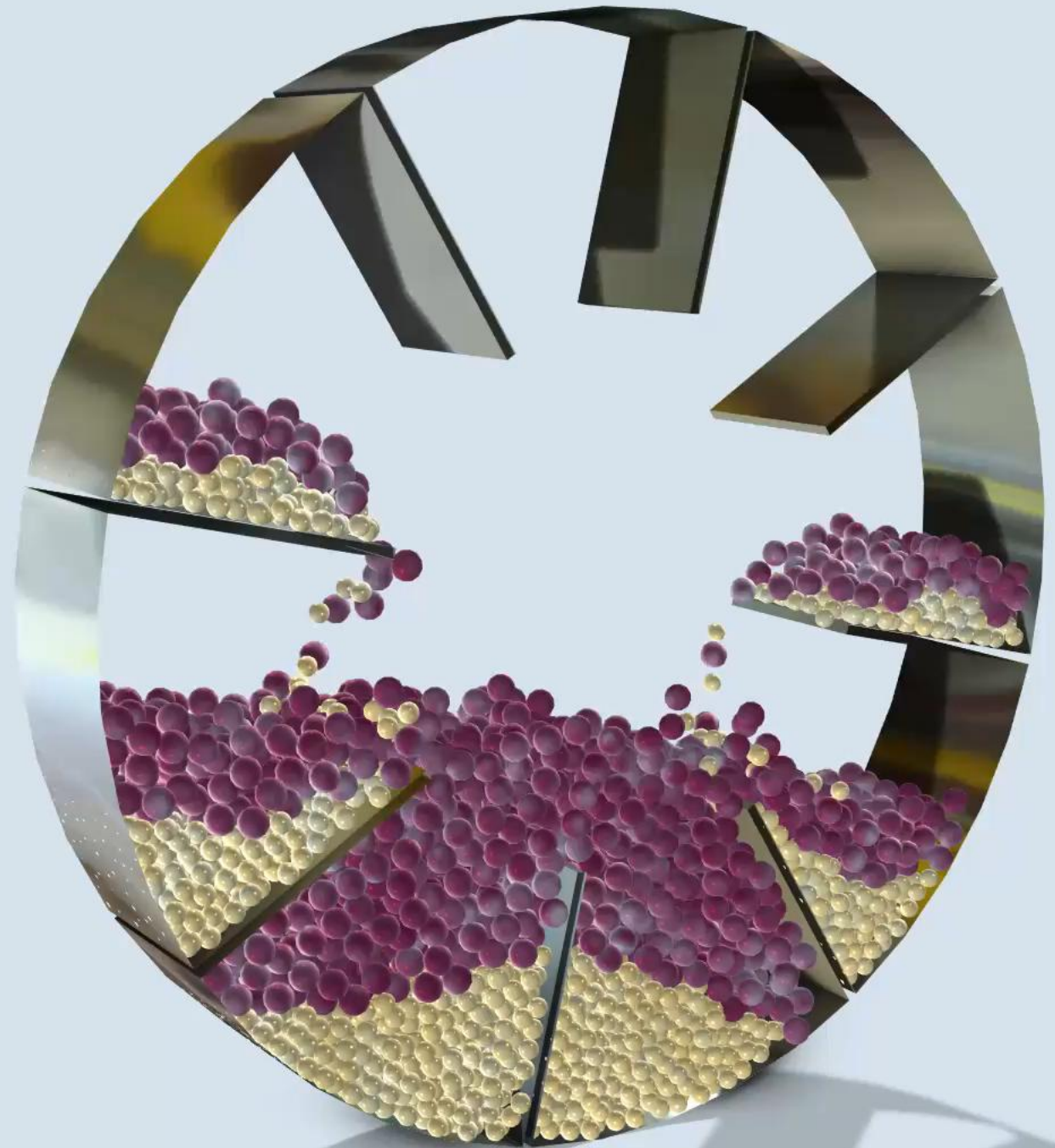


New general contact in the time explicit model

MAJOR NEWS

Granular Flow Module

- Grains with contact and friction:
 - Discrete element method (DEM)
- Applications:
 - Conveyers and mixers
 - Ore and coal
 - Powders
 - Grains, seeds, and beans



MAJOR NEWS

GPU Support for All Physics

- NVIDIA® cuDSS for one or more GPUs
- cuDSS = The NVIDIA CUDA® Direct Sparse Solver
- "up to 20 times faster than a CPU for complex multiphysics"
 - Floating point precision: Single vs. Double
 - Hybrid compute mode: use both GPU and CPU for solving
 - Multiple GPUs mode
- NVIDIA® GPU with a compute capability of 6.0 or higher is required

Settings

Direct

Run to Selected Run

Label: Direct

General

Solver: cuDSS

Reuse preordering

Preordering algorithm: MUMPS, PARDISO, SPOOLES, Dense matrix, **cuDSS**

Row preordering

Row preordering algorithm: Automatic

Factorization algorithm: Automatic

Pivot threshold: 1

Floating point precision: Double

Pivoting perturbation: 1E-13

Hybrid memory mode: Automatic

Memory fraction for hybrid mode: 0.8

Memory limit (MB): 4096

Use hybrid compute mode

Advanced

Use multiple GPUs

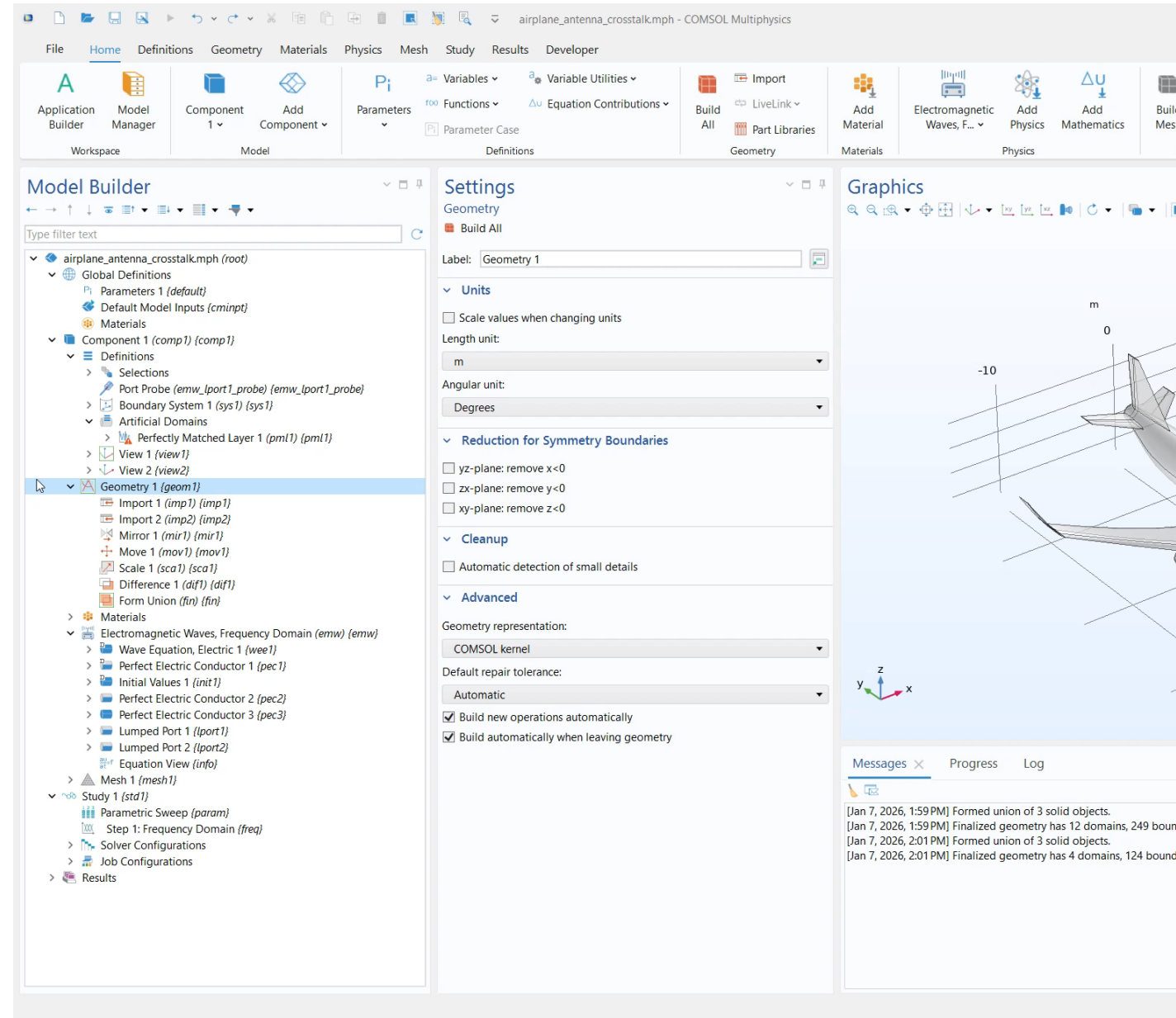
> Error

> Changes from Default Settings

Core Capabilities

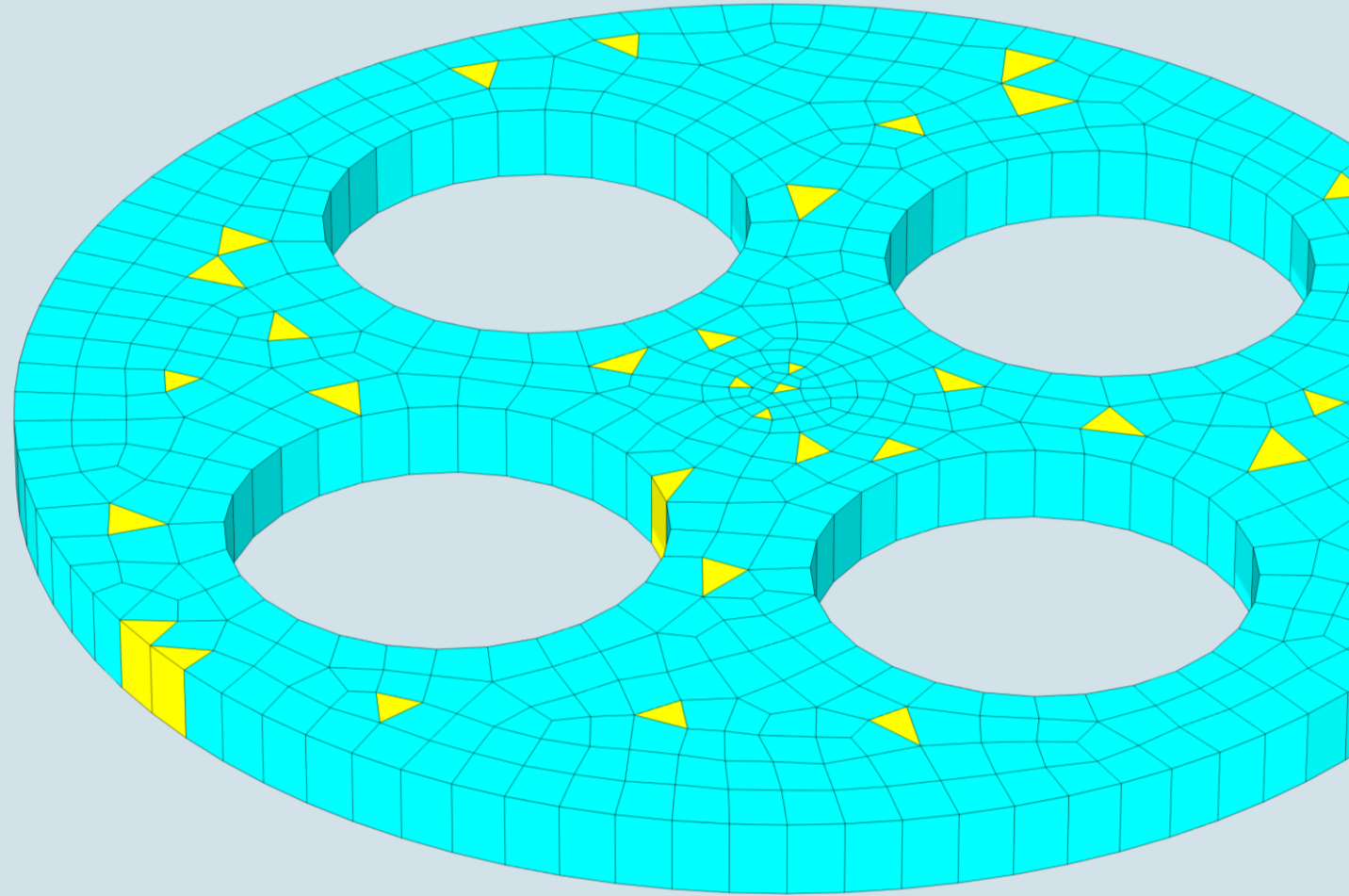
Creating Bounding Geometry

- Useful for defining fluid domains or PML domains surrounding objects
- Primitives such as block, sphere, cylinder bounding the geometry, plus some margin



Quad Dominant Meshing

- Smoother element size transitions
- Allows for a mix of quads and triangles
- Improved quality and robustness compared to previous algorithm



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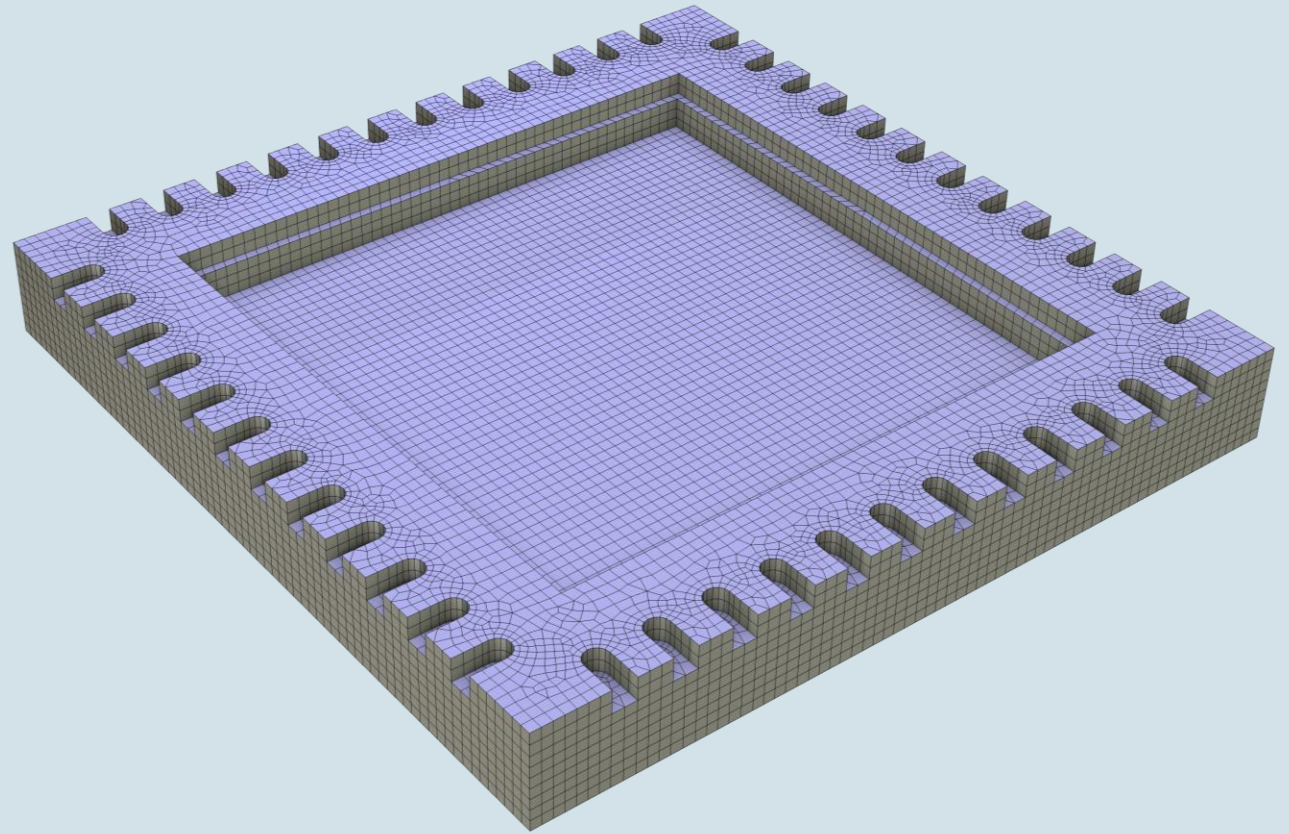
The screenshot displays the COMSOL Multiphysics software interface. The top menu bar includes File, Home, Definitions, Geometry, Materials, Physics, Mesh, Study, Results, and Developer. The main workspace is divided into several panels:

- Model Builder:** Shows a hierarchical tree of the model. The 'Mesh 1' node is selected, and its sub-nodes 'Size', 'Swept 1', and 'Free Tetrahedral 1' are visible. A blue circle highlights the 'Mesh 1' node.
- Settings:** Shows the 'Mesh' settings for 'Mesh 1'. The 'Sequence Type' is set to 'User-controlled mesh'. The 'Build Settings' section has the option 'Build new operations automatically' unchecked.
- Graphics:** Displays a 3D visualization of the meshed geometry, showing a smooth transition between different element sizes. A coordinate system (x, y, z) is visible in the bottom right corner.

The bottom status bar shows 'Progress', 'Log', and 'Table' options.

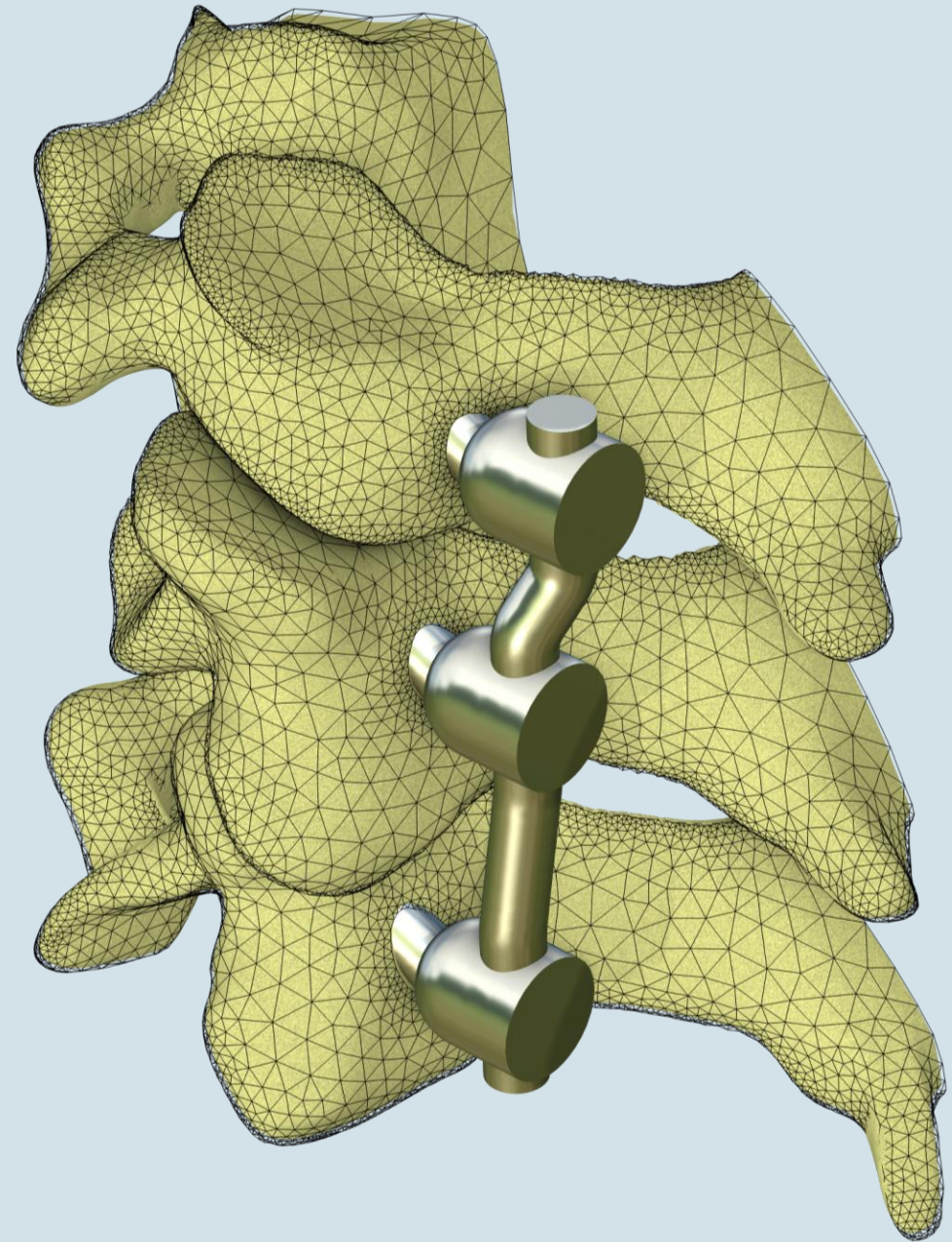
Improved Swept Meshing

- Automatic handling of domains with disconnected source faces
- Eliminates the need for manual partitioning of domains



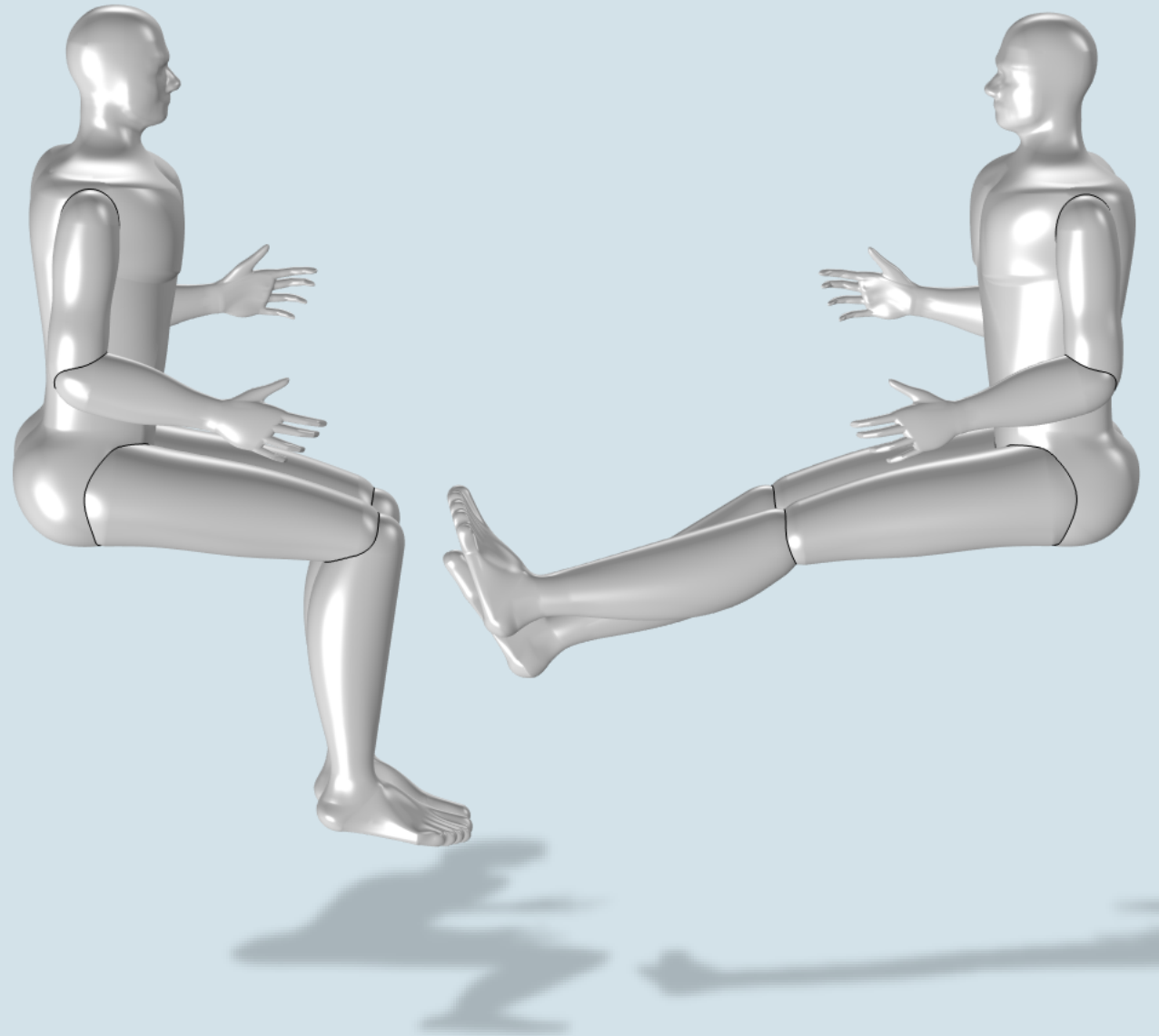
Mesh-Based Geometry

- Streamlined workflow for importing STL data or combining imported surface meshes with CAD
- Direct meshing on the resulting geometry using Mesh features
- Well-suited for topology optimization



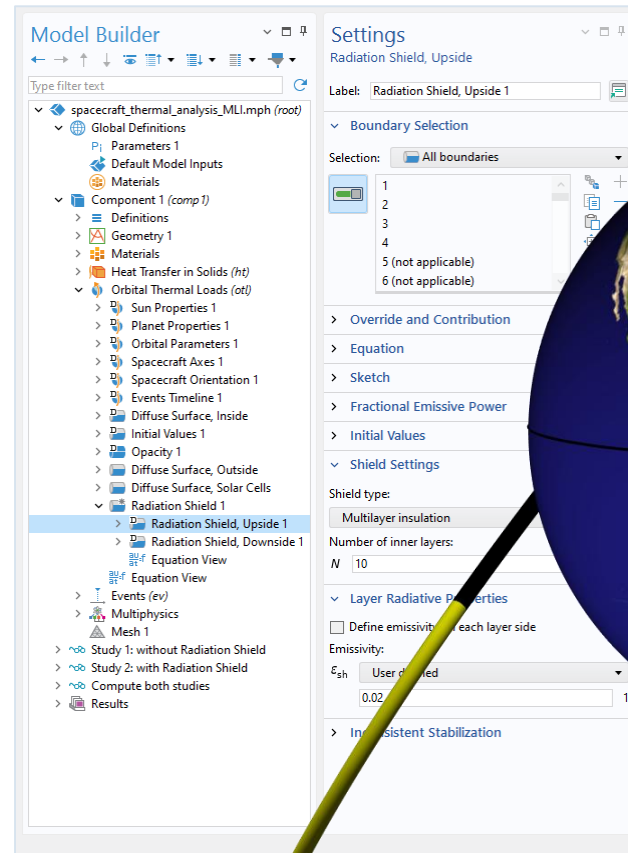
Humanlike Manikins

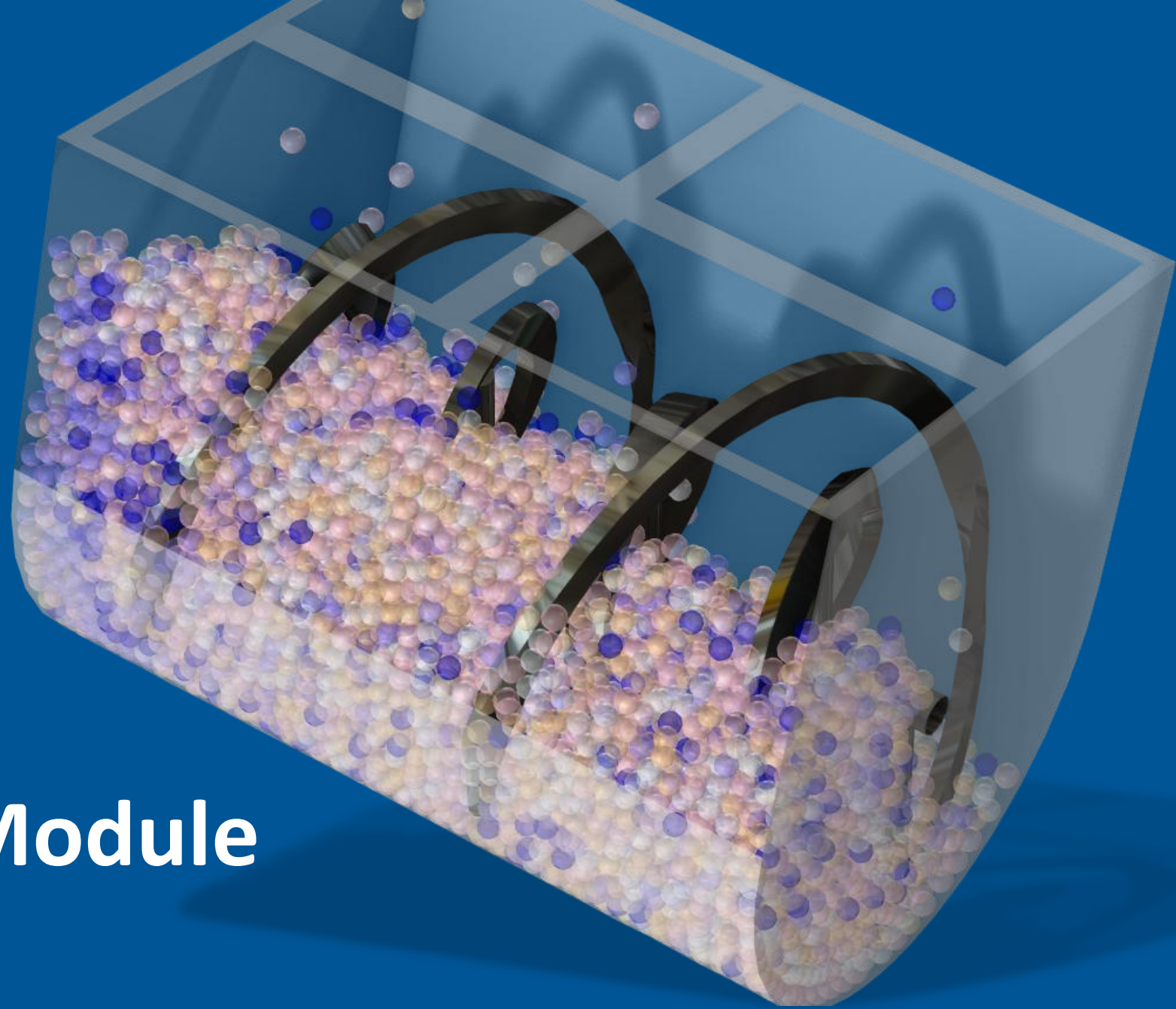
- Requires *Design Module*
- The Part Library now includes female and male human manikin geometry parts
- Sitting, standing, running, and generic positions



Radiation Shield for Orbital Simulations

- Requires *Heat Transfer Module*
- The multilayer insulation simulates a radiation shield
- One new Application Library model: *Spacecraft Thermal Analysis with Multilayer Insulation*
 - Radiation Shield consists of 12 layers: 10 inner layers, 1 innermost and 1 outermost layers





Granular Flow Module

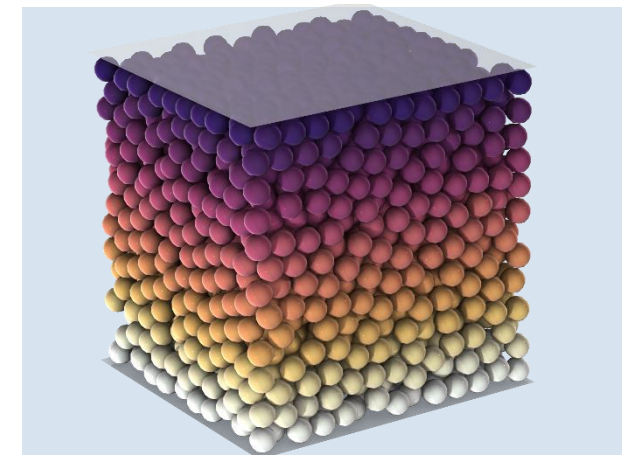
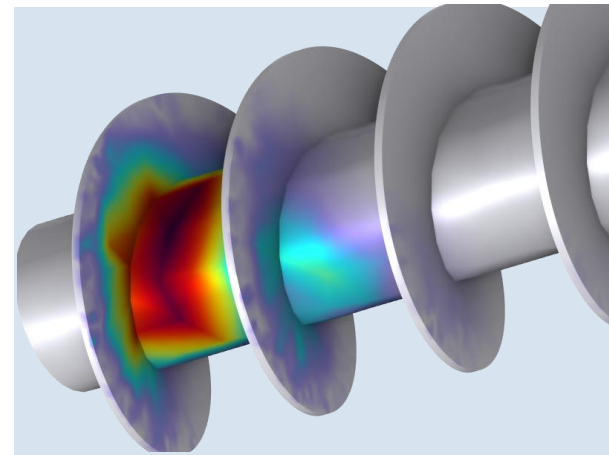
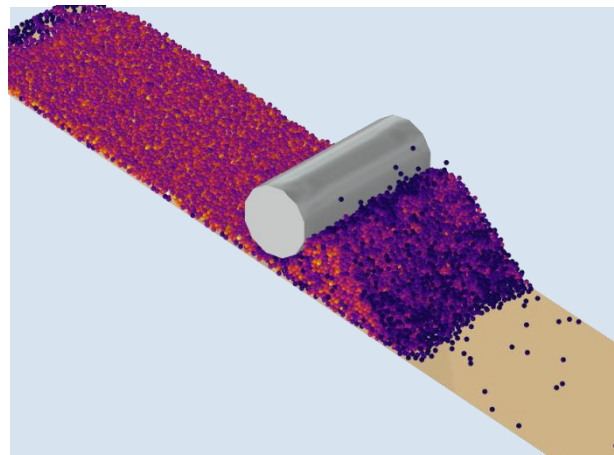
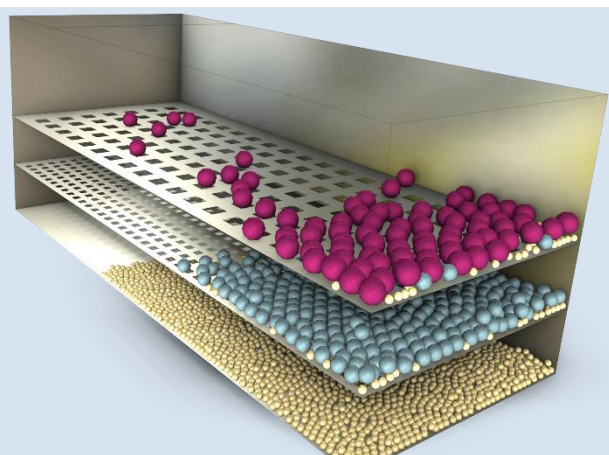
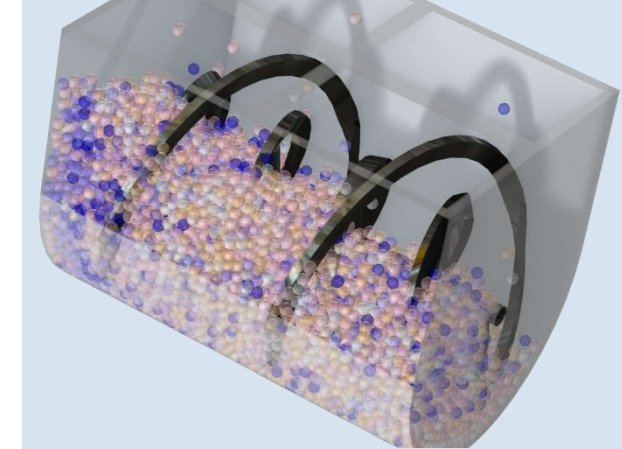
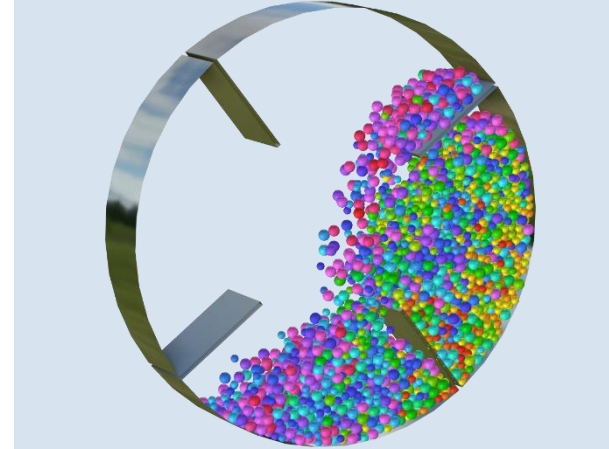
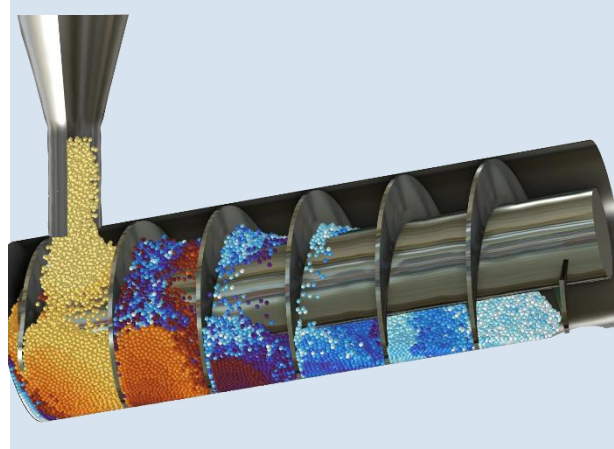
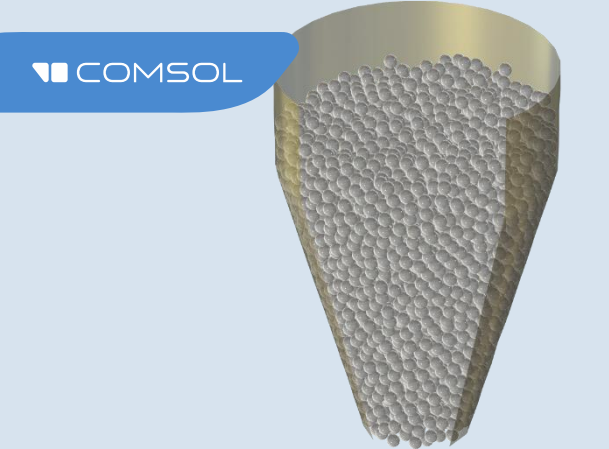
Granular Flow Module

- Simulate the bulk flow of granular materials
- Grains are discrete entities with finite size and shape
- Track position and velocity of individual grain in an external force field
- Compute contact forces between grains and between grains and walls using discrete element method (DEM)
- Track orientation, angular velocity and tangential displacement due to torque

The screenshot displays the COMSOL Multiphysics software interface for a simulation titled "screw_conveyor_short_120rpm_30degr.mph". The interface is divided into several panels:

- Model Builder:** Shows a hierarchical tree of the model. The "Granular Flow" module is selected, revealing sub-entities such as "Grain Properties 1", "Wall Properties 1", "Contact Between Grains 1", "Contact with Walls 1", "Wall Properties 2", "Force Accumulator 1", "Release 1", "Gravity Force 1", "Outlet 1", and "Bounding Box 1".
- Settings:** The "Granular Flow" settings panel is active. It includes:
 - Label:** Granular Flow
 - Name:** gran
 - Domain Selection:** Set to "Manual" with a list of domains 1 and 2.
 - Equation:**
 - Force:** "Contact force model" is set to "Hertz-MD". There is an unchecked checkbox for "Compute van der Waals force".
 - Rotational Resistance:** "Rotational resistance model" is set to "Varying torque model".
 - Additional Variables:** Three checkboxes are present: "Compute grain temperature" (unchecked), "Compute conductive heat transfer" (unchecked), and "Compute coordination numbers" (unchecked).
 - Advanced Settings:** "Seeds for random number generation" is set to "Unique". A table for "Maximum number of cells per direction" is shown:

1000	x
1000	y
1000	z
 - Dependent Variables:** A section for defining dependent variables.
- Graphics:** A 3D visualization of the simulation shows a funnel pouring granular material into a rotating screw conveyor. The grains are color-coded by position or velocity.



Application Areas

Some of the common application areas are filling/packing, emptying, transporting, mixing, separating and filtering, heat transfer.

For More 6.4 News Watch our Webinar!

- https://www.youtube.com/watch?v=DLtcY_BAyIk



News in COMSOL Multiphysics 6.4



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Nová verze COMSOL Multiphysics 6.4. - Ukázka novinek!



Do you want to learn how you can use new COMSOL features and add-on products? Find HUMUSOFT on Youtube!

Next Events

- 10.-11.9. Technical Computing Camp
www.humusoft.cz/event/technical-computing-camp-2026/
- 23.-25.9. COMSOL Conference Cambridge
www.comsol.com/conference



Thank you for your attention!