ANSYS User’s Group
ANSYS Workbench 19.2 Updates

Sriraghav Sridharan
Application Engineer, ANSYS Inc
Sriraghav.Sridharan@ansys.com
Mechanical
Adding New Analyses from Mechanical

• The New Analysis drop-down menu on the Standard Toolbar has been updated to include all the available Mechanical analysis types. Using this menu also adds a corresponding analysis system, with the appropriate connections, to the Project Schematic.
Linking Analysis Systems

- Mechanical now enables you to link and unlink analysis systems, such as Thermal-Stress or Pre-Stressed Modal, from within the application without having to return to the Project Schematic.

- This new capability automatically creates or deletes the links between the corresponding systems in the Workbench Project Schematic. This feature supports all linked analyses.
Deleting Environments from Mechanical

- You can now delete environments from within the Mechanical application if your Model includes more than one environment.
- This action also removes the corresponding system from the Workbench Project Schematic.
Saving and Archiving Projects

- Mechanical now offers the **File Menu** options **Save Project As** and **Archive Project**.
License Selection

• A new category and property has been added for the **Model** cell when selected in the Workbench **Project Schematic**.

• The new property, **License**, enables you to specify the license that will be used by a new instance of the Mechanical application for your model.
Import STL as Construction Geometry

• The new Construction Geometry option, STL, enables you to import and view an STL file in your simulation.

• Color, units, and visibility properties can be specified as in details view

• After import, the system displays the statistics (count of triangles in STL file)

• The STL can be translated (using ACT) and scaled (using different units input)

• By using “Show mesh” the outlines of triangles can be made visible
Mesh Copy

A new control to copy mesh from one body to another has been exposed, it called “Mesh Copy”.

**Feature highlights**
- This feature helps to reduce the mesh setup time for repetitive bodies/parts.
- Only source bodies are meshed and its copied to defined target bodies.
- Association to CAD is maintained after performing mesh copy.
- Supported only for solid bodies.

More information about this feature is available here.
Additive Manufacturing
Additive Print

The 19.2 Workbench Additive and Additive Print are the most robust versions available to date, providing even more accurate results, faster.

Additive Print

- Enhanced documentation.
  - Detailed step-by-step calibration procedure to the metal additive manufacturing machines

- Queue multiple sequential jobs to run automatically

- Additional input parameters to customize material plastic behavior
Workbench Additive

Additive Suite

Workbench Additive
• Improved UI with multiple enhancements
• Better control over positioning of their supports for specified design
• Detailed documentation and additional validation studies against physical builds
Topology Optimization
Topography Optimization (19.2)

- Topology optimization supported in Linux operating system
- **New** Lattice Optimization option to calculate lattice density
Topology Optimization (19.2)

Varying density lattice
Topology Optimization (19.2)

- AM (Additive Manufacturing) Overhang constraint is supported for creating self-supporting structures. Self-supporting structure is created based on Build direction and Overhang angle input from the user. Supported with Additive Suite license.

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**Details of "AM Overhang Constraint"**

<table>
<thead>
<tr>
<th>Scope</th>
<th>Optimization Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoping Method</td>
<td>Optimization Region</td>
</tr>
<tr>
<td>Optimization Region Selection</td>
<td>Optimization Region</td>
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</table>

<table>
<thead>
<tr>
<th>Definition</th>
<th>AM Constraint</th>
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</thead>
<tbody>
<tr>
<td>Type</td>
<td>Overhang Angle</td>
</tr>
<tr>
<td>Suppressed</td>
<td>No</td>
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</table>

<table>
<thead>
<tr>
<th>Location and Orientation</th>
<th>Global Coordinate System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build Direction</td>
<td>+Y Axis</td>
</tr>
<tr>
<td>Overhang Angle</td>
<td>45°</td>
</tr>
</tbody>
</table>

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**Copy of Topology Optimization**

- **Type:** Topology Density
- **Iteration Number:** 27
- **Date:** 7/31/2019 12:29 PM

- **Colors:**
  - Red: Remove (0.0 to 0.4)
  - Orange: Marginal (0.4 to 0.6)
  - Gray: Keep (0.6 to 1.0)

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**Copy of Topology Optimization**

- **Type:** Topology Density
- **Iteration Number:** 43
- **Date:** 7/13/2018 2:31 PM

- **Colors:**
  - Red: Remove (0.0 to 0.4)
  - Orange: Marginal (0.4 to 0.6)
  - Gray: Keep (0.6 to 1.0)
Topology Optimization (19.2)

- Inertia + Thermal loads in Static analysis in combination with Modal analysis
- Region of Manufacturing constraint to support Include/Exclude Exclusions option. The default is Include Exclusions.
- Supported for Pull out, Extrusion, Cyclic and Symmetry Manufacturing constraint.
Rigid Body Dynamics
New Motion Load ACT extension

- New Export Motion Load workflow
- Based on the ability to export assemblies in the updated configuration after an RBD transient analysis
- A single button allows to import dynamic loads on a given body for stress analysis
ANSYS Material Designer
**ANSYS Material Designer - Goal**

Model and analyze the **micro-structure**

**Fiber reinforced composite materials**

**Lattice structures**

To obtain averaged **material data** which can be used in subsequent simulations.
Basic Workflow

Specify constituent materials

Computed material
Homogenization

Material Designer employs the following procedure:

- Model the **micro-structure** (RVE/unit cell)

- Expose it to a set of **load cases**

- Extract the (force) **results**

- Obtain homogenized (averaged) **material properties**
Homogenization

The following properties can be computed:

- **Structural**
  - Linear Elasticity
    - Orthotropic elasticity (Young’s moduli, Poisson ratios, shear moduli)
    - Anisotropic elasticity (stiffness matrix)
    - Density

- **Thermal**
  - Orthotropic secant coefficients of thermal expansion
  - Orthotropic thermal conductivity
  - Specific heat
Why use Material Designer Efficient material data interpolation

Variable material data computed with Material Designer can directly be applied in regular ANSYS Mechanical simulations.

Import spatial fields
- element-wise
- node-wise
- layer-wise
Composites
Support of Material Designer Workflows

• The new Material Designer (MD) package computes constant and variable homogenized material properties of composite materials.

• For the first time, you can perform end-to-end analyses for variable material data in WB (e.g. shear dependent material properties)
  – Compute variable material properties in MD
  – Enable draping in ACP to get the shear angles
  – Solver and post-processing automatically consumes and considers the shear dependent properties
Support of Material Designer Workflows (cont.)

Load case: internal pressure
Result: non-uniform deformation

Shear Dependent Weave ($E_1$)

Draping Mesh and Shear Angle

Element-wise $E_1$
Draping

- Draping capabilities have been improved with respect to performance and usability, resulting in up to 10x faster draping simulations.
- A new option allows to take into account the lay-up thickness during the draping simulation, providing more accurate results especially for thick laminates (e.g. sandwich structures) with ply tapering and drop-offs.

Effect of the layup thickness on the shear angle calculated by ACP draping simulation with Draping Offset Correction.

Draping mesh with and without Draping Offset Correction.
Miscellaneous
Miscellaneous

MAPDL

- Inverse Solving

Reference Geometry (undeformed geometry)

Inverse Solving

Input Geometry (Deformed geometry under 100 Hgmm pressure)

Forward Solving with further loading

Geometry After Further Loading (Deformed geometry under 120 Hgmm pressure)
Discovery Live 19.2
Highlights
Parameter Studies

Large number of design possibilities can be evaluated and visualized quickly
Volumetric Heat generation

- Volumetric heat generation has been added to thermal studies
- Existing ‘Heat Flow’ condition it used, but now allows targeting one or more bodies as the location
- Heat flows evenly across the domain of target body
- Supports transient and steady state studies
Fluids Capabilities

• 30% solver speed up
• Swirl Inlet
  – Specify rotational component to inlet velocity in rpm
  – Velocity magnitude increases with distance from axis of rotation
• Rotating Wall
  – Rotational velocity can be applied to walls
  – Wall must be symmetric about rotation axis
  – Example use case: rotating wheels on a translating vehicle
• Convection (w & w/out radiation)
• Smoother transient chart results
• Transient end time now stored per solution
Verification manual

- Discovery Live results across a range of geometric cases and physics simulations
- Comparison to known expectation & AIM results
- Charts showing convergence w/ increasing fidelity
- Live results should not be used for final verification. Intended to provide general impression of accuracy only.

Verification Cases

1.0 Static Structural Analysis
   1.1 Statically Indeterminate Reaction Force Analysis
   1.2 Rectangular Plate with Circular Hole Subjected to Tensile Loading
   1.3 Stepped Shaft in Axial Tension
   1.4 Elongation of a Solid Bar
   1.5 Laterally Loaded Tapered Beam
   1.6 Circular Plate under Uniform Pressure

2.0 Modal Analysis
   2.1 Cantilever Beam Modal Analysis
   2.2 Simply-Supported Beam Modal Analysis
   2.3 Modal Analysis of an Annular Plate
   2.4 Modal Analysis of a Rectangular Plate

3.0 Thermal Analysis
   3.1 Heat Transfer in a Composite Wall
   3.2 Transient Heat Conduction in a Semi Infinite Slab
   3.3 Conduction in a Composite Solid Block
   3.4 Cooling of a Spherical Body
   3.5 Heat Transfer from a Cooling Spino

4.0 Fluid Analysis
   4.1 Laminar Flow Through a Pipe
   4.2 Pressure Drop in Turbulent Flow Through a Pipe
   4.3 Natural Convection in a Concentric Annulus
   4.4 Turbulent Flow with Heat Transfer in a Backward-Facing Step
   4.5 Laminar Flow through a Square Duct with Heated Walls
   4.6 Turbulent Flow Over a Forward Facing Step
   4.7 von Karman Vortex Shedding

Benchmark Cases

5.0 Benchmark Cases
   5.1 Tractor Axle Static Stress and Deformation
   5.2 Modal Analysis of a Robot Arm
   5.3 Modal Analysis of a Printed Circuit Board
   5.4 Static Loading of a Bracket
Discovery AIM 19.2
Highlights
Workflow enhancements

Meshing
• Curvature size function (similar to Workbench Mechanical)
• Automatic Body sizing controls for Multizone meshing
• Local mesh refinement for fidelity

Results Export
• New CSV export option – Export contour and vector plots to a CSV file

Structures
• Option to fix initial gaps/overlaps under Contacts
• Linearized Stresses for ASME code development

Thermal
• Multistep thermal analysis
• Auto-selection of convecting surfaces

Overall workflow improvements
Workflow enhancements

Guide Me Options to add Additional Physics

- New “Guide Me” options for fluids
  - Easily define setup for conjugate heat transfer and workflow for one-way fluid-structure interaction from existing flow solutions
Workflow enhancements

Adaptive Meshing for Blow Molding

- Adaptive Meshing for Polymer Blow Molding
  - Activate for blow molding to automatically improve mesh quality and contact accuracy

Initial mesh for blow molding solution

Area stretch ratio showing adaptive mesh
Fluent 19.2 Product Update
Simplified Meshing Workflow

• New Task-Based Fluent Meshing Workflow for Watertight CAD Geometry

• Create high-quality meshes even for complex geometries with minimal training and effort

Guided workflow based on meaningful tasks

Graphical illustration of task status, warnings, etc.

User can choose to modify task-list and save as a custom workflow

Each task presents simple inputs and choices

Intelligence and automation behind the scenes minimize user intervention
**Advanced Poly-Hexcore Meshing Technology**

- Based on ANSYS’s unique Mosaic™ technology

- Available in the new Watertight CAD Fluent Meshing workflow and the Object Auto-Mesh dialog box

- Combines a hexahedral bulk volume with polyhedral prism and transition cells at the boundaries.

- Numerous benefits compared to other technologies
  - Reduced cell count
  - Higher cell-quality
  - Reduced memory consumption
  - Higher solver performance

*Formula 1 wing showing polyhedral cell transition to prismatic poly cells in boundary layer*

*High-quality mesh even in submillimeter through-holes of turbine blade*
System Coupling 2.0 in Workbench

- ANSYS System Coupling 19.2 offers more flexibility in workflows using a powerful 2.0 coupling version

- Fully script complex multiphysics simulations with >2 participants and solve on HPC clusters

- Full user documentation and example scripts available