Autodesk Simulation Mechanical – One Model, 60 Tips, 90 Minutes to Success!!!

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SM1755 – Autodesk Simulation Mechanical – One Model, 60 Tips, 90 Minutes to Success!!!

Learning Objectives
At the end of this class, you will be able to:

- Manipulate you Simulation Mechanical interface like a pro!
- Optimize your Linear Static Stress and MES analyses!
- Create photo realistic results images!
- Never call technical support again!!!!!!

About the Speaker

James Herzing

James Herzing has been using the Autodesk Simulation software for nearly 9 years, working in various positions that deal with customer issues, and trying to ensure their success. Currently, he works as part of the Industry Strategy and Marketing division as a member of the Go-to-Market team. He graduated from the Pennsylvania State University in 2004 with a BS in Mechanical Engineering and a minor in Engineering Mechanics. He has presented in 9 Autodesk University classes, and is hosting or assisting in 5 sessions at this year's Autodesk University.

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Tip #1: Fusion for Simplification

Why: Your model is too complex or poorly created you don’t own CAD, it’s not on local

Where: Free in the box with your Simulation purchase

Tip #2: Inventor View and Mouse Controls

Why: You’re used to your mouse controls from a certain CAD package

Where: Tools: Application Options: Mouse Options/View Options
Tip #3: Absolute Mesh Size

Why: You need to ensure elements through the thickness of a part, consistent mesh

Where: Mesh: 3D Mesh Settings: Options, set Type to Absolute Mesh Size

Tip #4: Set Retries to Zero

Why: Quickly determine which parts have geometry problems or need a finer mesh

Where: Mesh: 3D Mesh Settings: Options
Tip #5: Unchecking Virtual Imprinting and Geometry Mesh Size Function

Why: Allows more control for consistent meshing between parts, ignoring details
Where: Mesh: 3D Mesh Settings: Options: Model tab

Tip #6: Defining Mesh Settings for Individual Parts

Why: Interested in results on individual parts, better contact between parts
Where: Right click on parts of interest in model tree, choose CAD Mesh Options: Part
Tip #7: When to Use Refinement Points

Why: Control your element count, optimize mesh for contact, better results near detail areas

Where: Vertice select: Right click: Add: Refinement Point (or Mesh tab: Refinement panel)

Tip #8: Determine Geometry Errors and Contact Quality

Why: Your mesh may not be good enough for quality contact between parts

Where: Draw Tab: Design Panel: Layer Control
Tip #9: Midside Nodes Help Results and Speed

Why: You can have high quality results and a lower element count, so your model solves faster
Where: Right click on the part in the model tree, enter Element Definition, pick Midside nodes

Tip #10: Smart Bonding to Keep Parts from Separating

Why: It is sometimes difficult to get parts to have matching meshes for bonded contact to work
Where: Setup Tab: Model Setup Panel: Parameters: Contact Tab
Tip #11: Creating Your Own Material Library

Why: You verify the properties for each material, the whole company can use, unique materials

Where: Tools Tab: Options Panel: Manage Material Library

Tip #12: Minimize Your Model Tree

Why: It is easier to select and edit multiple parts in your assembly

Where: On your keyboard... hold down Control, Shift and M at the same time
Tip #13: Save Time by Copying Part Properties

Why: You do not need to enter the various dialog menus repeatedly

Where: Select a part in the model tree, right click, copy desired attributes

Tip #14: Defining Linear Contact for Accurate Analyses

Why: Default bonded contact does not always accurately represent the real world situation

Where: Choose 2 parts, surfaces or contact groups, right click and pick proper contact
Tip #15: Adjusting the Ribbon Bar

**Why:** Sometimes you drag the panels to the wrong spot or close them accidently.  
**Where:** Click on the fly out menu on panel, or right click in the gray ribbon area.

Tip #16: Unpinning the Model Tree for More Room

**Why:** This gives you more room to work on large models and a better canvas for images.  
**Where:** Top right corner of the model tree, looks like a pin.
Tip #17: Working without Using the Ribbon is Possible

**Why:** Faster way to choose your commands, customize your menu for most used buttons

**Where:** The top of the screen above the ribbon, and right side

Tip #18: Graphics Options for Clear Display

**Why:** Remove ruler from screen, remove gradient for clear pictures

**Where:** Tools: Application Options: Graphics tab
Tip #19: Test Your Analysis with a Fast Gravity Run

Why: Instead of running an analysis that takes a long time and may fail, test with a simple run

Where: Set up your model mesh, properties and BC, and only apply gravity to see if it works

Tip #20: Applying a Remote Force

Why: Create loads for your model without the need for creating additional CAD geometry

Where: Setup Tab: Loads Panel: Remote Force (also through right click options)
Tip #21: Automatic Line Element Creation

Why: Automatically create line elements where joint browser fails, to apply masses, connection

Where: Draw Tab: Design Panel: Contact Elements

Tip #22: Use Lumped Masses Instead of CAD Geometry

Why: Save on elements and modeling time while keeping necessary mass

Where: Setup: Loads: Nodal Weight
Tip #23: Where to Find Mass Participation and How Much You Need

Why: If you don’t have enough mass participation, your linear dynamics results are no good
Where: Report tab: Log File, find mass participation (aim for at least 80%)

Tip #24: How to Schedule Your Analysis for Different Times

Why: Don’t use up your processing while you need to do work, schedule it for later
Where: Tools: Application Options: Analysis Tab
Tip #25: Connecting with Multiple Lines for Accurate Results

Why: If you only use 1 line, you get hot spots. Spider webbing removes those and is accurate

Where: Use contact element creator or draw lines to connect items together

Tip #26: Modifying the Legend for Clearer Results, Viewing High Stress Elements

Why: You can get a better understanding on results, and see areas of failure

Where: Results Contour: Settings Tab: Legend Properties
Tip #27: Determine Stress through Thickness of Parts

**Why:** Verify stress in your part through thicknesses to avoid failure  
**Where:** Select nodes in the results, right click and choose Path Plots

Tip #28: Mirror Plane for Symmetry Models

**Why:** You can see an image of your full model when only part is modeled  
**Where:** Results model tree, right click on proper mirror plane and choose Activate
Tip #29: Factor of Safety for Your Model

**Why:** Determines how close to failure your part is

**Where:** Results Contour: Stress: Safety Factor (choose values for FoS to be based on)

Tip #30: Fatigue Analysis

**Why:** Yielding is not the only way parts fail, repeated loading and unloading causes failure

**Where:** Analysis Tab: Analysis Panel: Fatigue Analysis
Tip #31: Photo Realistic Images with Autodesk Showcase Interoperability

Why: Because you want fancier looking images to show your customers

Where: Results Contours: Captures panel: Export to Showcase

Tip #32: Design Optimization and Autodesk Labs

Why: Find Autodesk’s newest tools on Labs, and optimize your part thickness and weight

Where: www.labs.autodesk.com; Setup: Model Setup: Parametric Study
Tip #33: Simulation CFD and Simulation Mechanical Interoperability (Hydra)

Why: Map results from Simulation CFD to determine stress values in Simulation Mechanical

Where: www.labs.autodesk.com; Setup: Model Setup: Parameters: Thermal tab

Tip #34: Accessing the Various Resources for Help

Why: You can learn everything about the software from the forums, wiki, tutorials, etc.

Where: Getting Started: Help panel
Tip #35: CAD Associativity with Most CAD Packages

**Why:** Make geometry changes and have your loads and boundary conditions remain

**Where:** Use most CAD packages and press Send to Simulation

Tip #36: Updating Inventor Parameters in Simulation Mechanical

**Why:** No need to go back to Inventor to make updates to your geometry

**Where:** Mesh: CAD Additions: Inventor Parameters
Tip #37: Choosing the Right Material Model for Your Parts

Why: Default Isotropic material models do not always best represent your materials
Where: Right click on Element Definition: Edit, pick best option for you

Tip #38: 3D Kinematic Elements Save Time in Analysis

Why: No stress is calculated for these parts, saving you time
Where: Right click on Element Type: 3D Kinematic
Tip #39: Simplify Models with the Bolt Wizard

Why: Saves elements and analysis time from contact, simplifies your model

Where: Mesh: CAD Additions: Bolt

Tip #40: Using Joints in Your Models

Why: Create pin or universal joints instead of CAD Geometry

Where: Mesh: CAD Additions: Joint
Tip #41: Line Elements to Simplify Complex Models

*Why:* Removes a large amount of detail from CAD while providing an accurate solution

*Where:* Right click on the Element Type and choose which line element you want

Tip #42: Selection Groups for Easy Contact Definition

*Why:* Defining selection groups is faster and easier than defining 1 contact pair at a time

*Where:* Select desired surfaces on your model, choose Selection Groups: Create New Group
Tip #43: Turn Updating to “Never” when Contact Pairs won’t Change

Why: This will drastically improve the time contact models take to analyze
Where: Right click: General Surface-to-Surface Contact: Updating

Tip #44: Apply Friction in Your Contact Models

Why: Friction is a more accurate representation of your model
Where: In the Contact menu, click under Parameters in the table
Tip #45: Manually Define Contact Stiffness for Faster Analyses

Why: Automatic contact stiffness can be slow to converge on the proper solution

Where: From the screen for friction (above), Advanced button: General tab

Tip #46: Define Interaction and Initial Distances for Contact Elements

Why: Limits the number of elements created and duration they are accounted for, faster solve

Where: From screen above, click on the Geometry Tab
Tip #47: Take Advantage of Prescribed Displacements

**Why:** They are the most stable, easy to analyze loads in MES

**Where:** Setup: Constraint panel: Prescribed Displacement

Tip #48: Apply Boundary Conditions to Remove Degrees of Freedom

**Why:** The more DoF that you remove from your analysis, the faster it will solve

**Where:** Setup: Constraint panel: General Constraint
Tip #49: Use Zones for Your MES Analyses

Why: You can use more time steps of areas of difficult convergence, and less in other areas

Where: Setup: Model Setup tab: Parameters: Event tab

Tip #50: Use Updated Lagrangian for High Strain Parts

Why: This option changes settings to help converge more quickly when strain is high

Where: Right click on part with high strain in tree: Edit: Element Definition: Advanced tab
Tip #51: How to Determine Weight and Center of Gravity for Your Model

Why: Verify the accuracy of your CAD geometry and material properties, determine tipping

Where: Analysis tab: Analysis panel: Weight and Center of Gravity

Tip #52: Use Remote Submission to Free Your Machine

Why: You can run your analyses on another machine while doing work on yours

Where: Tools: Application Options: Analysis: Configure Remote Execution
Tip #53: Autodesk Simulation Mechanical 360 – Cloud Analysis

Why: Frees your machine, unlimited solving in parallel, powerful machines, pay as you go

Where: You can download the trial today, or contact your sales rep!

Tip #54: Von Mises Precision to Verify Mesh Quality and Accuracy

Why: You can verify the quality of your mesh and see hot spots in your results

Where: Results Contours: Stress: von Mises Precision
Tip #55: Modify Your Legend Options for Clearer Results Interpretation

Why: You don’t need 7 digits in your displacement results, save on clutter
Where: Results Contours: Settings panel: Legend Options

Tip #56: Applying and Manipulating Slice Planes

Why: More easily review results without parts blocking your view, rotate planes as necessary
Where: Results Options: View Settings panel: Slice Planes
Tip #57: Automatically Create a Report of Your Findings

**Why:** Easily capture analysis information such as loads, materials, elements and results

**Where:** Reports tab: Report: Setup Panel: Configure

Tip #58: Apply Custom Logos to Your Report

**Why:** Advertise your company instead of the Autodesk logo

**Where:** In the Configure menu, check box next to logo and watermark, browse to image
Tip #59: Display Your Results in an Inventor Publisher Document

Why: Your stress and displacement results can be part of your Publisher presentation
Where: Results Contours: Save to file: .fbx file to be opened in Publisher

Tip #60: Watch Simulation TV for Help with All Your Simulation Needs!

Why: Updated with multiple videos weekly covering all Autodesk Simulation solutions
Where: www.simsquad.com – look for the Simulation TV link on the page!!