MFG226529

3D CAD Preparation and Cleanup

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Learning Objectives

- Learn how to effectively prepare 3D models for simulation
- Learn how to reduce 3D model size and complexity for rendering
- Learn how to share 3D models while protecting IP
- Learn how to correct/fix typical 3D modeling problems (if time permits)

Description

Working with less-than-ideal 3D CAD models is par for the course. This class will cover workflows and techniques to help users prepare and clean up 3D models for downstream use in simulation, rendering, CAM, and protection of IP.

Speaker(s)

Luke has been involved with design, engineering and analysis since 1995. His career started in telecommunications designing mobile production equipment for TV and radio. He has taught design and engineering at Pittsburgh Technical Institute and has spent over 10 years as an application engineer for an Autodesk reseller and Blue Ridge Numerics. His various roles as educator, end-user and provider give him a unique perspective on identifying, understanding and helping solve design and engineering challenges. As the Technical Marketing Manager for the core manufacturing solutions at Autodesk, he is responsible for the development, creation and implementation of relevant content and tools that help users understand and utilize the Autodesk Design and Manufacturing Portfolio.

Paul Munford is a laugher, dreamer, bon vivant, CAD geek and Technical Marketing Manager for Autodesk in the UK. Paul 's background in manufacturing items for the construction industry gives him a foot in digital prototyping and a foot in Building Information Modeling (BIM).
Paul was a speaker at Autodesk University for the first time in 2012, and he says it's the most fun anyone can have with 250 other people in the room.

Learn how to effectively prepare 3D models for simulation

When we think about preparing models for simulation there are a few things we want to make sure happen. First of all, you want to make sure no matter what you have high-quality results. You don't want to simplify a model and then lose the validity of the results.

Second, you want to make sure you have proper mesh resolution, meaning you have denser mesh where you need it and lower mesh count where you don't need it. No sense in wasting resources if the results don't change. Next, we want to think about simulation speed. Getting three simulation results from a simplified model at the same time it would take to get one results from a fully detailed model usually provides better insight and allows for more simulation feedback.

So how do we get here using geometry tools inside of Autodesk Inventor? The very first thing you want to make sure that you do is you remove any small details that will not affect the final result. Think of things such as fillets and chamfers. In most cases, these features add significant element count while having little effect on the end results.

We also want to make sure that the geometry is as perfect as it can be. Anytime you have small gaps or slivers between bodies simulation tools typically over mesh or failed to mesh all together. You've all heard the analogy garbage equals garbage out. This is especially true for simulation.

Make sure that you merge bodies when appropriate. For example: If you're only doing a fluid flow analysis and you're not worried about thermal affects you can literally model in most cases a single body. If you are doing a structural analysis or a thermal analysis merging bodied only make sense when you have similar materials.

Filling voids are very similar to merging bodies, if you're doing an external fluid flow analysis any internal voids can be filled to reduce mesh account and save on runtime since you'll have a reduced element count.
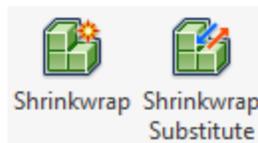
Workflow:

Complex Inventor assembly } simplified part } CFD/Mechanical/Moldflow/Nastran In-CAD

Example:
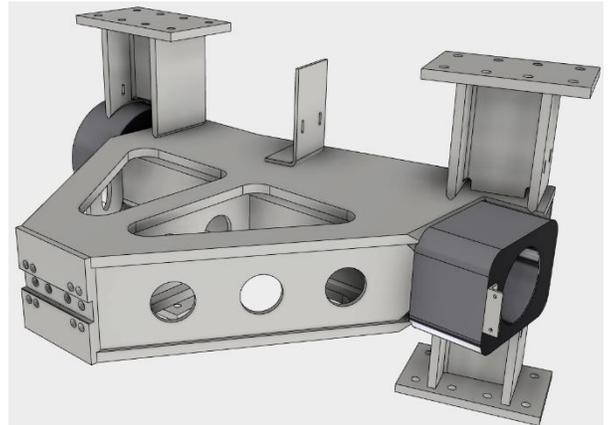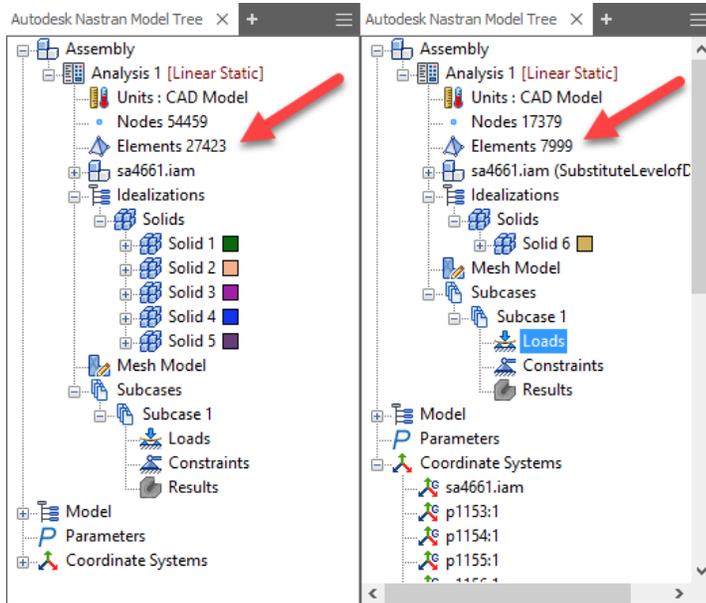
Command reference:
- [Shrinkwrap part](#)
- [Shrinkwrap Substitute](#)
- [Create simplified part](#)
- [Delete face](#)
- [Direct edit](#)
- Remove details
- Fill voids

Keys to reduce size and complexity for rendering

When you think of rendering you typically don't think about simplification. The truth is simplified models render faster. Why ray trace internal components if you're doing a rendering of only external components.

So, the number one thing we want to do with rendering is to have faster rendering times. We also want to make sure material selection is easier and we only want to render objects that are in the view.

Removing small details does help with the render time since those faces are not calculated during ray tracing. When we merge bodies and leverage the selection tool we can quickly apply materials prior to rendering. We also want to make sure we're only rendering components that we want to render. We can use selection tools in combination with views to only render only the components we want in our current view.

Workflow:

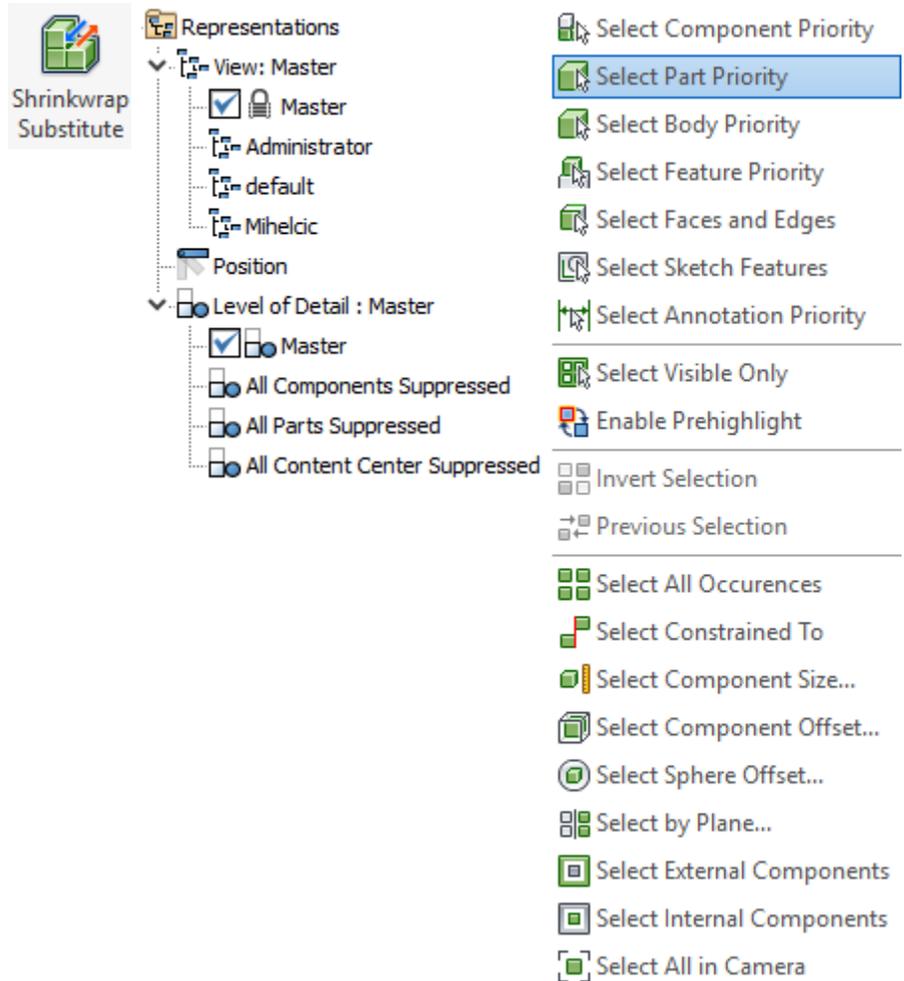Complex Inventor assembly } simplified assembly } Ray tracing in Inventor

Example:
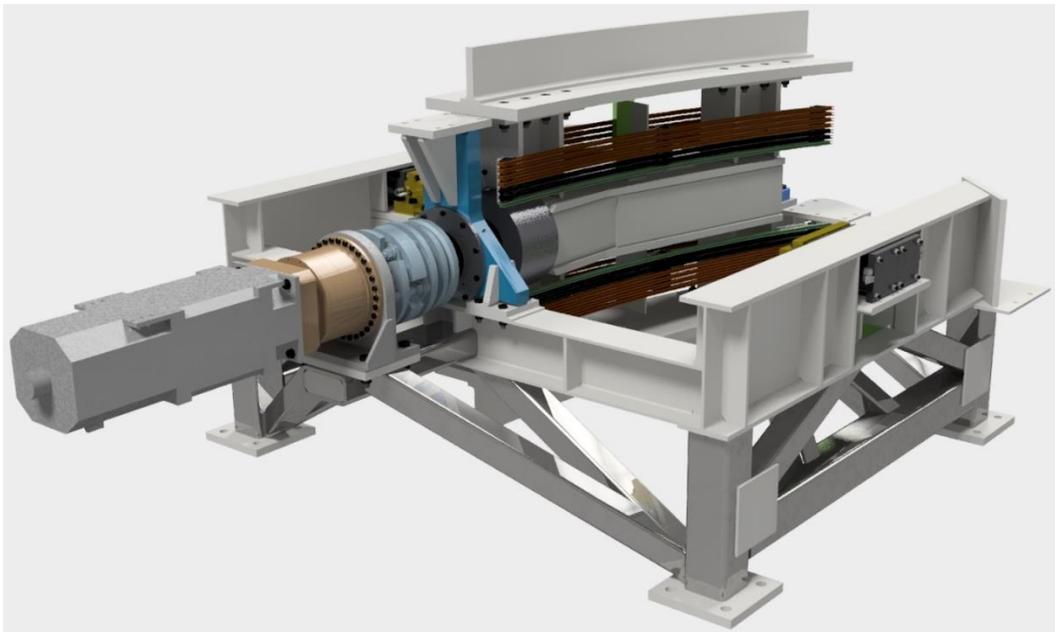
Time to Fine Ray Tracing: 277 seconds and 198 seconds or 33% time savings.

Command reference:
- [Shrinkwrap Substitute](#)
- [Level of Detail](#)
- [View reps](#)
- Selection priority

Shrinkwrap Substitute

Representations
- View: Master
  - ☑ 🔒 Master
  - Administrator
  - default
  - Mihelcic
- Position
- Level of Detail : Master
  - ☑ Master
  - All Components Suppressed
  - All Parts Suppressed
  - All Content Center Suppressed

- Select Component Priority
- **Select Part Priority**
- Select Body Priority
- Select Feature Priority
- Select Faces and Edges
- Select Sketch Features
- Select Annotation Priority
- Select Visible Only
- Enable Prehighlight
- Invert Selection
- Previous Selection
- Select All Occurences
- Select Constrained To
- Select Component Size...
- Select Component Offset...
- Select Sphere Offset...
- Select by Plane...
- Select External Components
- Select Internal Components
- Select All in Camera

Keys to share models while protecting IP

Protecting your intellectual property may be what most important aspects of your job. The last thing you want to do is to share information they can easily be redesigned and copied by a competitor. Engineers and designers need to share the information, but they need to share it intelligently and in a way that protects their information. One of the best ways to do this inside of Autodesk Inventor is with simplification tools.

We also want to make sure we're not re-creating data just for collaboration purposes, this is not only a waste of time but also resources. We also want to make sure the information easily be shared with vendors and partners.

One of the first things you probably want to do is to remove small details. This will not only make the files you are sharing smaller but I will also provide a quick and easy way to remove detail.

Merging multiple bodies or components until one is also another way to protect the design intent of your products.

Typically when your sharing your data it's primarily used for clearance and placement purposes. In these cases, you can typically remove all internal components and futures.
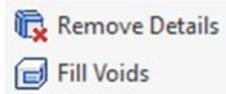
Workflow:

Complex Inventor assembly } simplified part } export to neutral file format

Example:
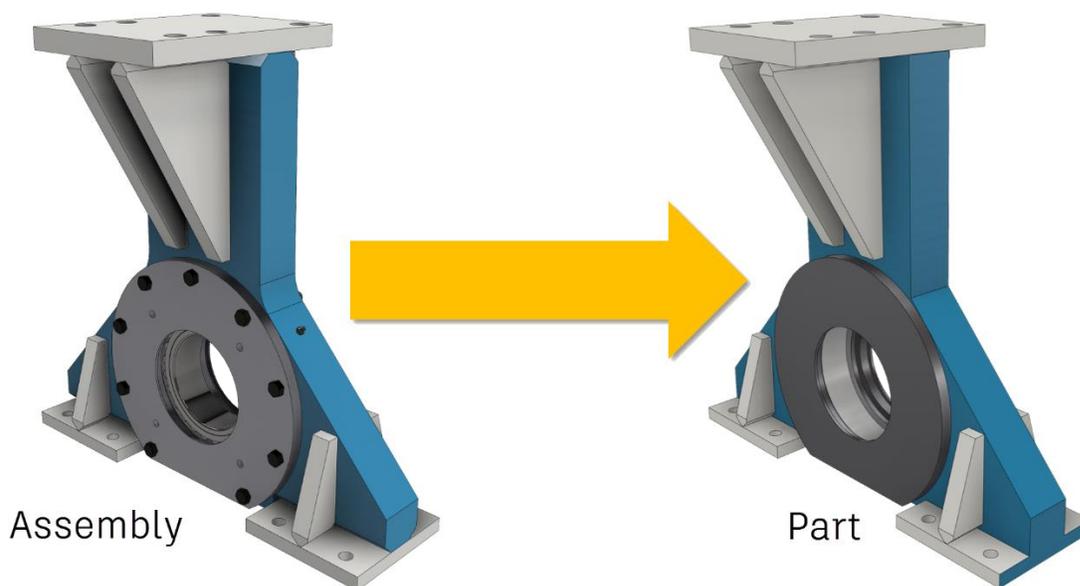
Command reference:
- [Shrinkwrap part](#)
- [Create simplified part](#)
- [Delete face](#)
- [Direct edit](#)
- Remove details
- Fill voids
- Defend envelopes

Keys to correct and fix typical modeling problems (if time permits)

Protecting your intellectual property may be what most important aspects of your job. The last thing you want to do is to share information they can easily be redesigned and copied by a competitor. Engineers and designers need to share the information, but they need to share it intelligently and in a way that protects their information. One of the best ways to do this inside of Autodesk Inventor is with simplification tools.

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Command reference:
- Repair bodies
- Patch
- Stitch
- Delete face
- Direct edit
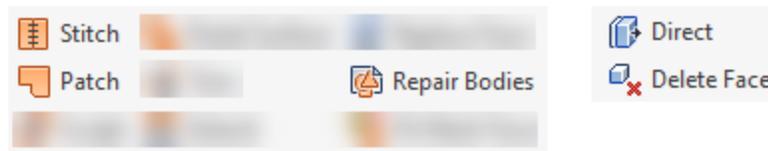
Final class handout will be distributed during class and updated on AU class site.