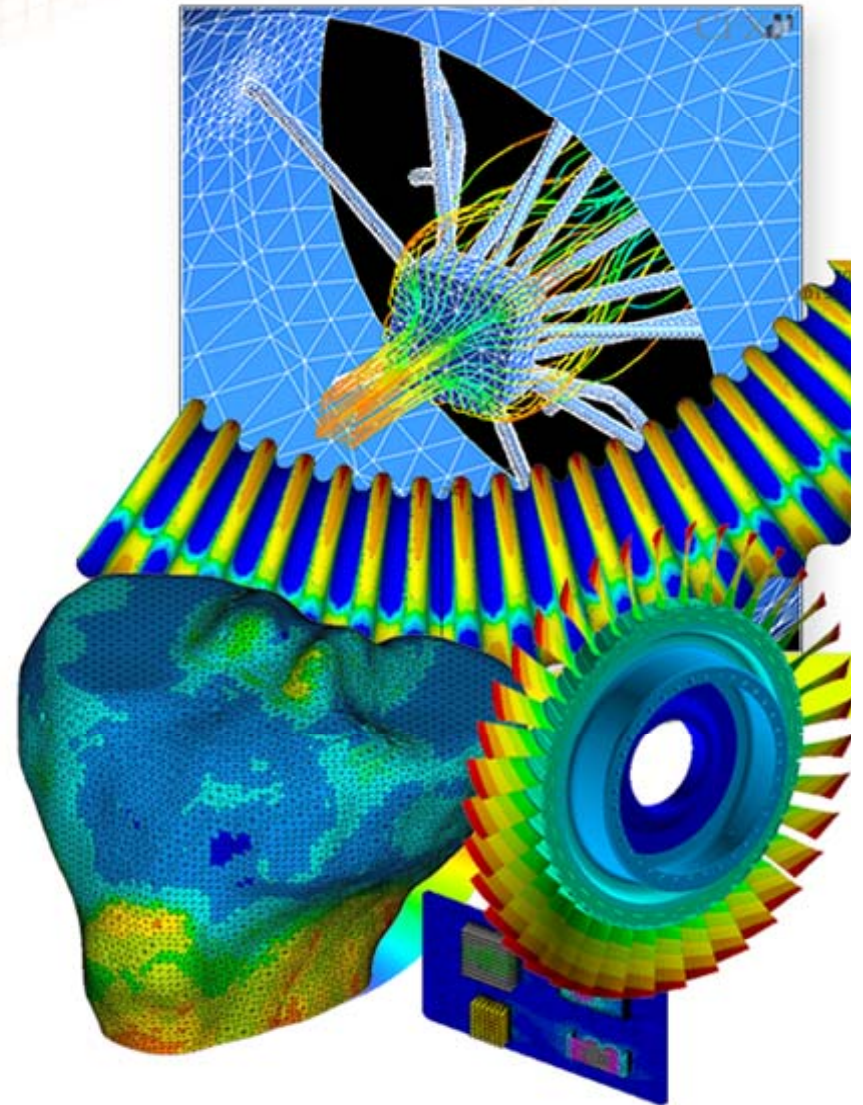


Application Customization Toolkit

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March 2013



- If you are a New York or New Jersey resident you will earn continuing education credit for attending the full webinar, participating in the polls and completing a survey at the conclusion of the webinar.
- Other e-Learning webinar topics coming up are:

Advanced Postprocessing Techniques in Workbench

April 9th or 11th

Generating Inflation Layers for CFD

April 16th or 18th

Submodeling in ANSYS 14.5

April 30th or May 2nd

- Visit www.caeai.com for details.

What is ACT?



- ACT (Application Customization Toolkit) is a new capability in WB designed to allow customizations of the Workbench Mechanical interface.
- These customizations can include things like:
 - Specialized loads
 - MAPDL Elements and options not directly available in WB.
 - Specialized post-processing
 - Use of MAPDL macros
 - FE model information and access.
 - Use of 3rd party solver
- ACT provides the internal mechanisms that allow you to customize an ANSYS Workbench application without compiling external code or linking with existing ANSYS libraries.

What Can ACT Do?

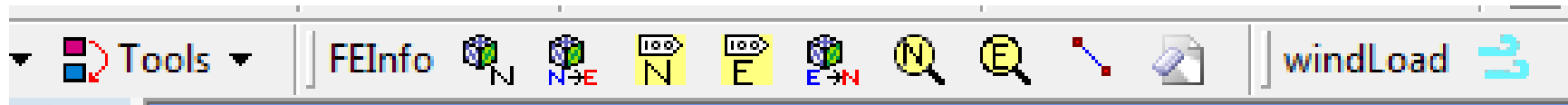


- Since ANSYS is a general purpose FE element code, it may not always provide the most direct method for analyzing each persons specific situation.
- ACT will allow you to add custom feature to the Mechanical interface that are specific to your industry or even one particular model.
- ACT extensions can relieve some of the pains and difficulties in specific modeling areas
 - Eliminate the need for command blocks.
 - Automate certain hand calculations.
 - Easily incorporate certain previously developed APDL macros into the WB Mechanical GUI.
- What ACT is not:
 - ACT is not a tool for scripting the use of already existing Mechanical features.

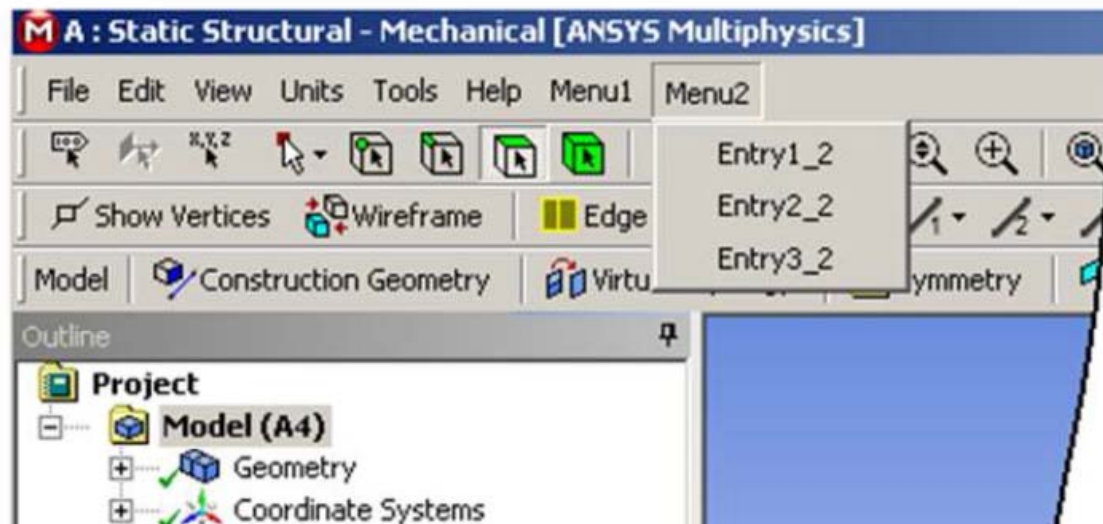
ACT Implementation



- ACT customizations can show up as new tool bar buttons

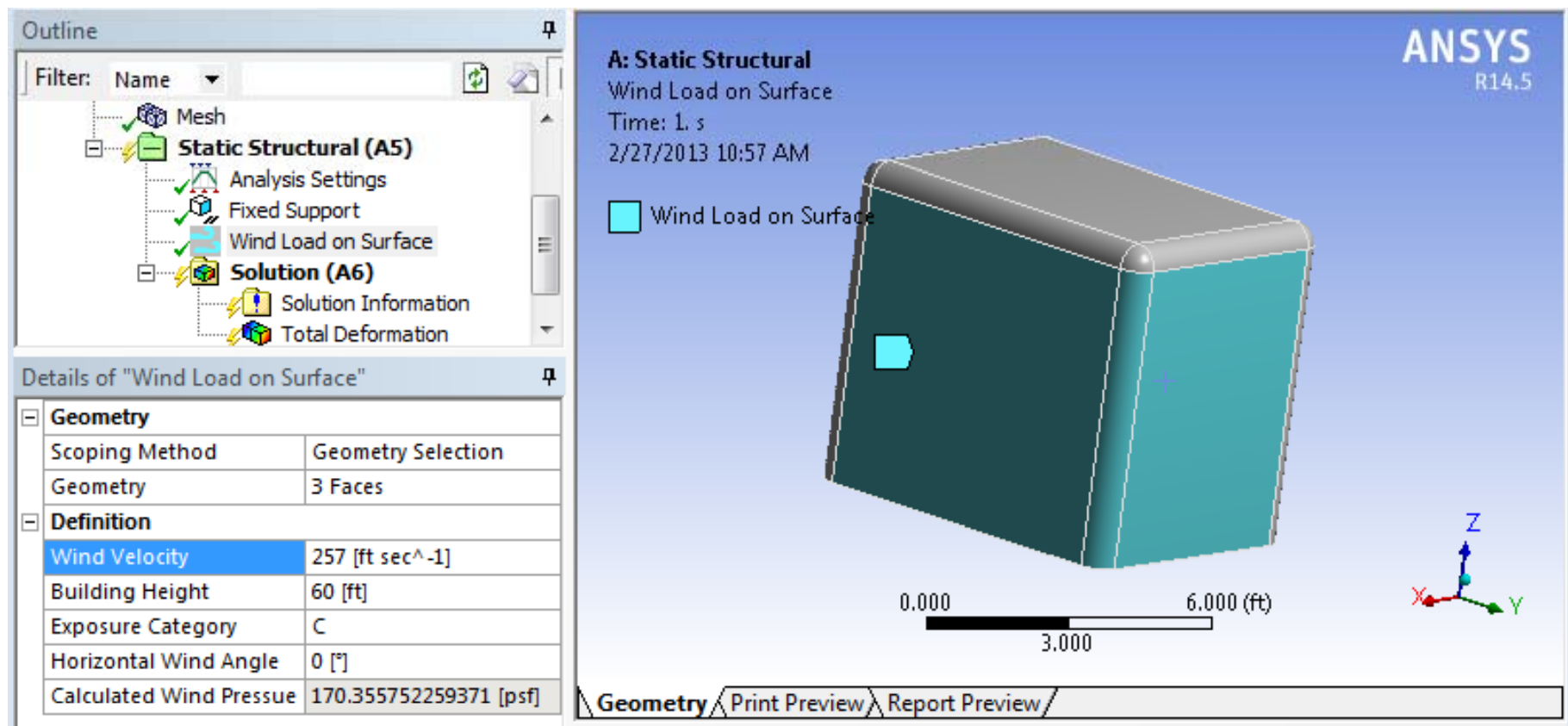


- Or as new menus



ACT Implementation

- These custom buttons function just like regular Workbench tools, items are added to the tree and the settings can be modified in the details pane:



Outline

Filter: Name

- Mesh
- Static Structural (A5)
 - Analysis Settings
 - Fixed Support
 - Wind Load on Surface
- Solution (A6)
 - Solution Information
 - Total Deformation

Details of "Wind Load on Surface"

Geometry	
Scoping Method	Geometry Selection
Geometry	3 Faces

Definition	
Wind Velocity	257 [ft sec ⁻¹]
Building Height	60 [ft]
Exposure Category	C
Horizontal Wind Angle	0 [°]
Calculated Wind Pressure	170.355752259371 [psf]

A: Static Structural
Wind Load on Surface
Time: 1. s
2/27/2013 10:57 AM

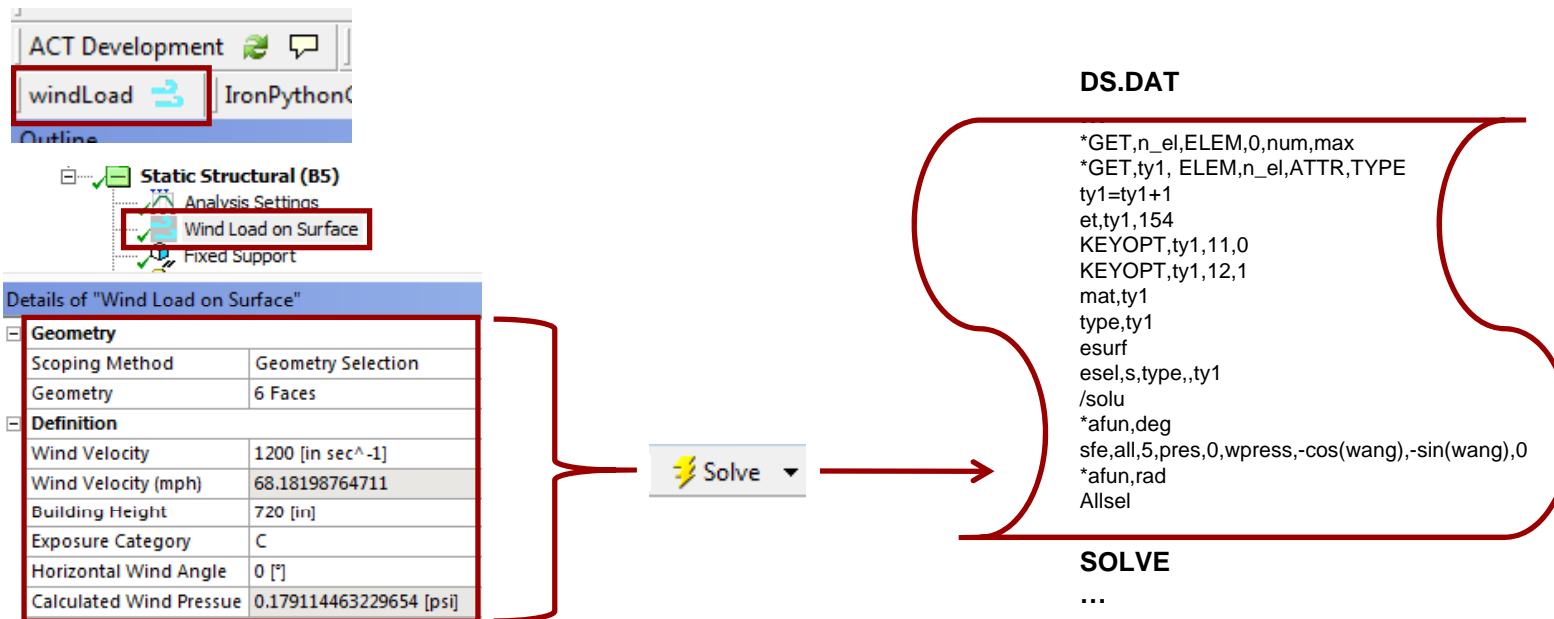
ANSYS R14.5

Wind Load on Surface

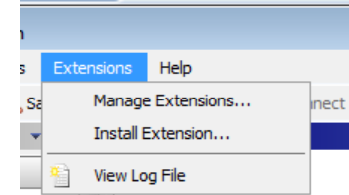
0.000 3.000 6.000 (ft)

Geometry | Print Preview | Report Preview

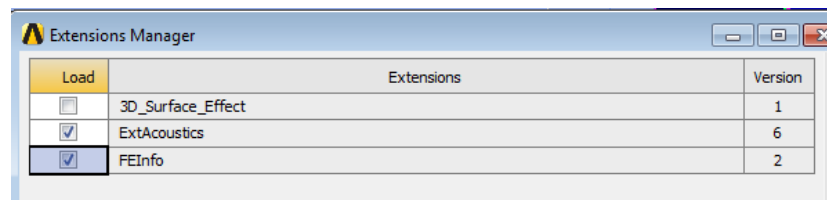
- ACT Extensions are created by a combination of XML files and Python Scripts.
 - XML files define the buttons, icons and details information.
 - Python scripts perform the operations in Mechanical
 - Main function – Extract the data from the user entered details and write items to the DS.dat file.



- To use ACT extensions no additional licensing is required!
 - To install a compiled extension file simply go to Extensions > Install Extensions and browse for the .WBEX file



- To use the extension in a particular project, go to Extensions > Manage Extensions and check off the extensions to use.



- To develop and compile ACT extensions an additional license (ANSYS SDK license) is required.
 - This license gives the ability to compile extensions from the source Python and XML files
 - It also entitles the user to technical support for ACT.
 - ACT has a fully documented API and Developers Guide.

- There are many pre-developed free ACT extensions available for your use. Some examples include:
 - [3D Surface Effect Extension R145 v1](#)
Create a 3D surface effect using SURF154 elements
 - [Acoustics Extension R145 v6](#)
Expose 3D acoustics solver capabilities
 - [BeamEndRelease Extension R145 v1](#)
Expose the end release feature for beam elements and enable advanced graphic post-processing for beam results
 - [Convection Extension R145 v1](#)
Expose convection with pilot node capability
 - [FE Info Extension R145 v4](#)
Expose node and element related information
 - [FSI Transient R145 v1](#)
Map temperature and pressure loads (from a CFD calculation) to a multi-step Mechanical analysis for transient one-way FSI
 - [MatChange R145 v1](#)
Change material ID to user specified value for the selected bodies
 - [Morphing2D Extension R145 v1](#)
Perform a set of morphing capabilities on 2D models
 - [Non Linear Results Info Extension R145 v1](#)
Enable tracking for non-linear solutions (contact & Newton-Raphson residuals)
 - [Piezo Extension R145 v2](#)
Expose piezo-electric solver capabilities
 - [Submodeling Extension R145 v1](#)
Sub-modeling for shell-to-solid (R14.5 native implementation already supports solid-to-solid sub-modeling)
 - [Workbench LS-DYNA Extension R145 v1](#)
Setup, solve and post-process an LS-DYNA simulation within workbench mechanical

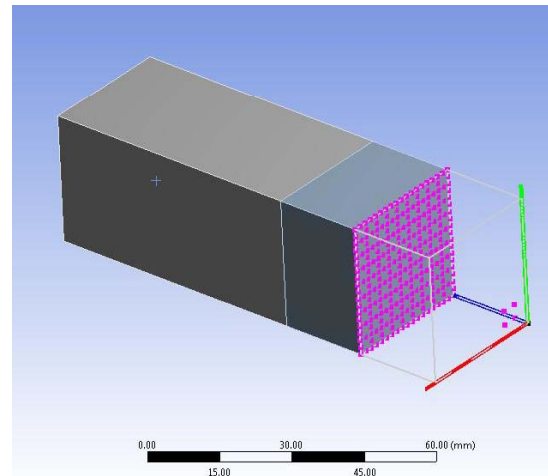
ANSYS Premium ACT Extensions



- ANSYS also has some advanced ACT extensions that are available:
 - Automated CMS Substructuring
 - Easily convert bodies into superelements
 - Ability to export and import superelements
 - Automatically does expansion pass and combines results with non-superelement results



1. SE groups
2. Top Down SEs
3. Import SE
4. Expand SEs
5. Export SEs



ExtCMS

Outline

Filter: Name

- Connections
- Mesh
- Named Selections
- SuperElement
- Modal (A5)
 - Pre-Stress (None)
 - Analysis Settings
 - Fixed Support
 - Fixed Support 2

Details of "SuperElement"

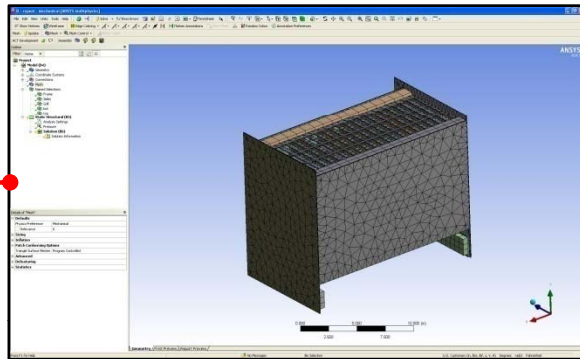
Superelement Part Definition	
Scoping Method	Geometry Selection
Geometry	
Master DOF's Definition	
Master Node Selec...	Automatic Selection
Auto detect maste...	Contacts(Interface); ...
SEOPT options	
Matrix generation ...	Stiffness and Mass
Expansion method...	BACKSUB
CMSOPT options	
Number of Modes ...	
Beginning Frequen...	Program Controlled
Ending Frequency ...	Program Controlled
Interface Method ...	Fix
Nested Superelement Definition	
Make Nested SE	No
Lock Option	
Lock Option	Unlocked SE

— Assembly Manager

- This ACT extension enables the user to combine two or more completed Mechanical models into a single model without having to re-do the contacts, loads, material properties, etc.
- It is extremely useful for any customer who performs Mechanical analysis on individual components, but then also needs to simulate the performance of an assembly of these components.
- The tool is also useful for creating assemblies that contain several copies of a component (e.g., a four-wheel assembly using four copies of the single wheel component).
- Combines: Geometry, mesh, coordinate systems, contacts, named selections, material properties, loads/bcs.
- Can pattern imported models by placing them at any location and orientation.

Assembly Manager

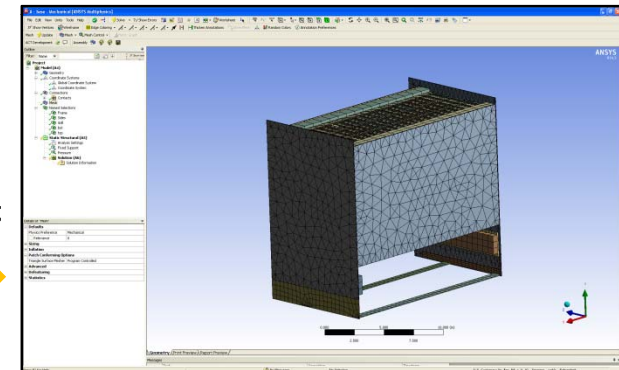
- Reuse 1 model multiple times



Model component:
Stored as a component using the "Export" feature

Assembly Manager			
Active	Imported	Description	Coordinate System
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	D:\Temp\assembly_t1_files\user_files\repeat	Global Coordinate System

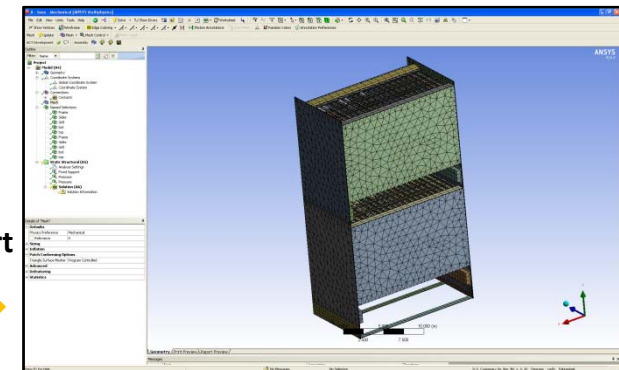
First import



Same component @ a different coordinate system

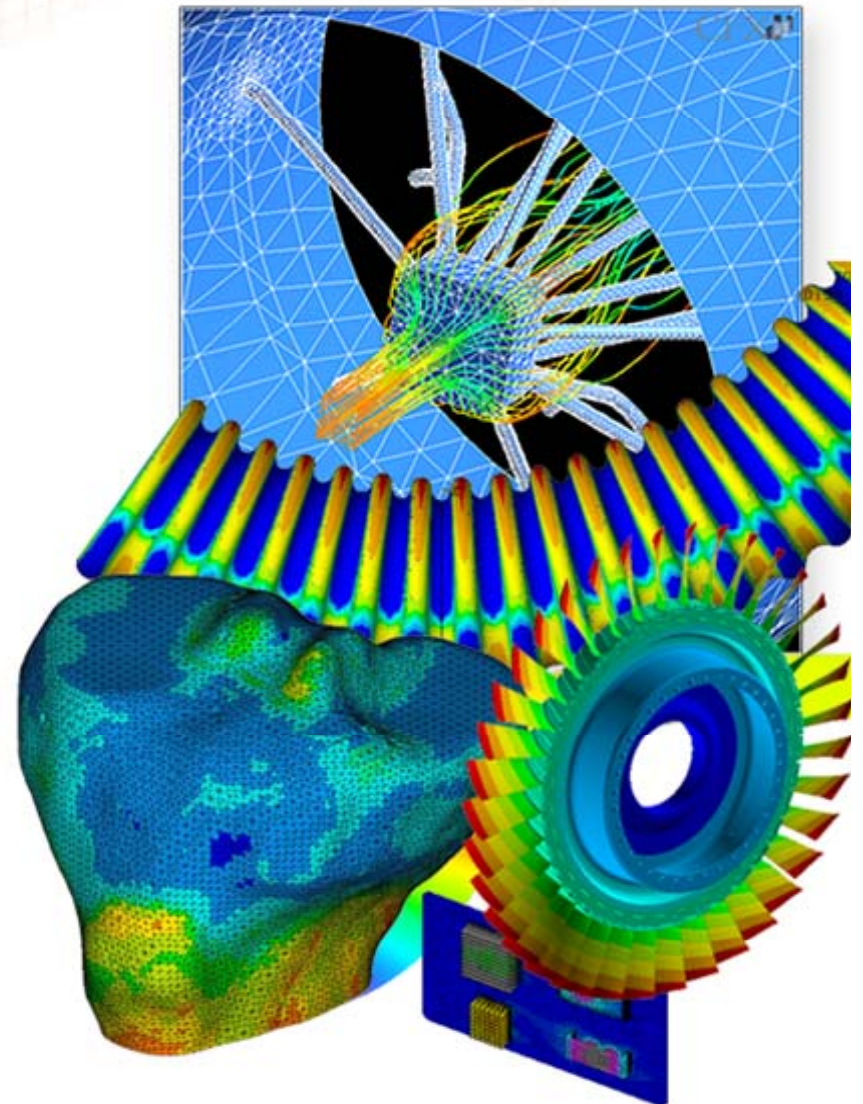
Assembly Manager			
Active	Imported	Description	Coordinate System
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	D:\Temp\assembly_t1_files\user_files\repeat	Global Coordinate System
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	D:\Temp\assembly_t1_files\user_files\repeat	Coordinate System

Second import



- At CAE Associates we have the expertise to develop ACT extensions to help you improve your efficiency in modeling and performing complex analyses in WB.
 - Please contact us if you would like to discuss the development an ACT extension.

ACT Extensions Demonstration



ACT Example

- A company designs rooftop structures, these structures must withstand different wind load criteria in different situations.
 - ASCE standard for calculating wind loads is rather complicated and can be prone to errors:

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I \text{ (lb/ft}^2\text{)}$$

$$G = 0.925 \left(\frac{(1 + 1.7g_Q I_z Q)}{1 + 1.7g_V I_z} \right)$$

$$F = q_z G C_f A_f \text{ (lb) (N)}$$

- Develop an ACT extension that prompts the user for the relevant factors and automatically applies the correct load.