

Lecture 7

CAD Connections and Parameterization

14.0 Release

Fluid Dynamics

Structural Mechanics

Electromagnetics

Systems and Multiphysics

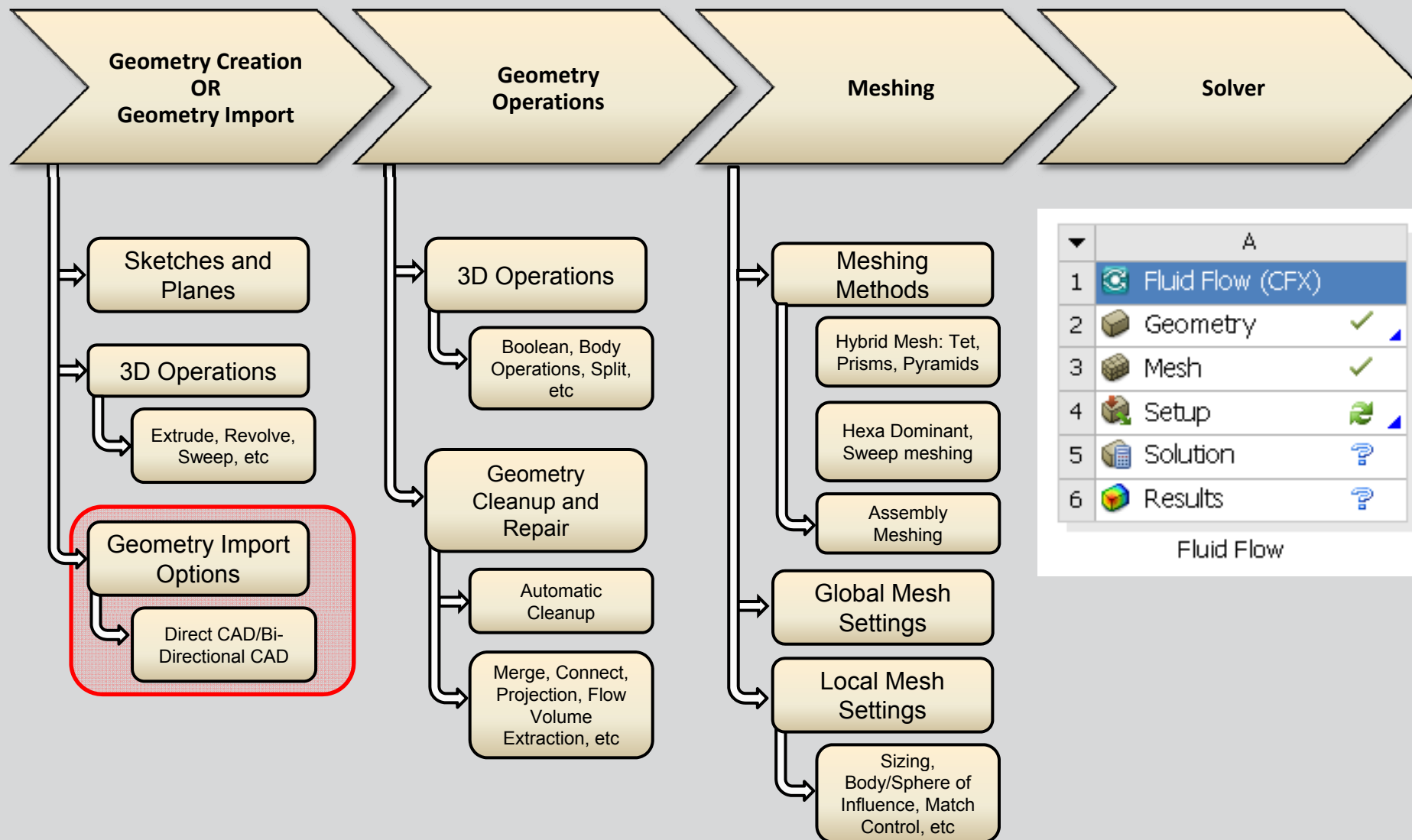
Introduction to ANSYS Meshing

CAD Connections and Parameterization

What will you learn from this presentation:

- **CAD Connections**
- **Bi-Directional Connectivity**
- **Named Selection Manager**
- **Parameterization**

Preprocessing Workflow

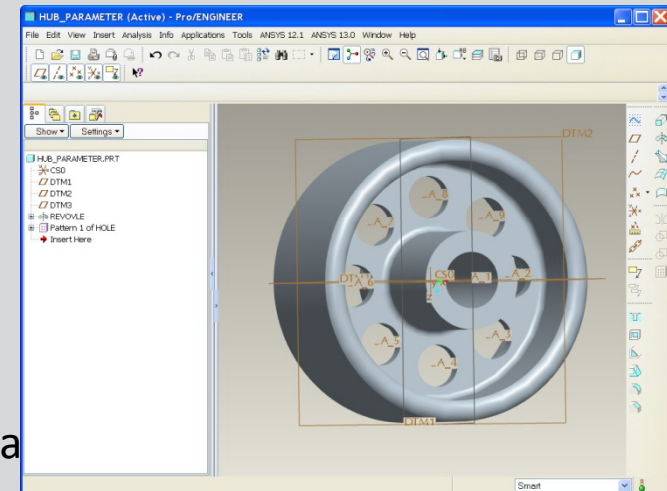


	A
1	Fluid Flow (CFX)
2	Geometry ✓
3	Mesh ✓
4	Setup
5	Solution ?
6	Results ?

Fluid Flow

CAD Connections: Introduction

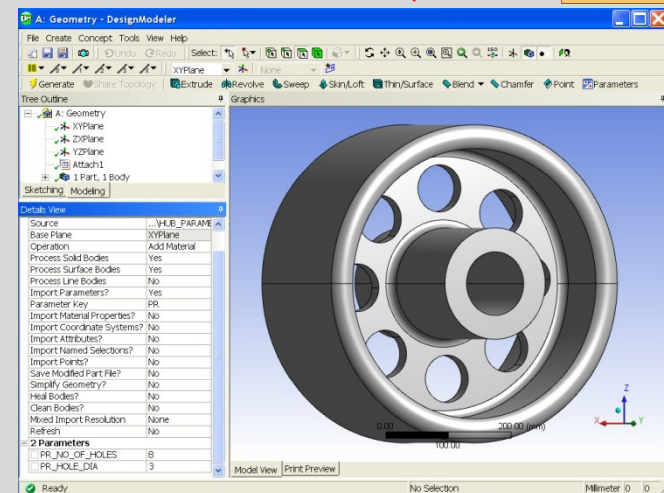
- CAD Connections
 - Transfer CAD geometry to DM/AMP
- Two approaches
 - Approach I (Import)
 - Import neutral files in STEP, IGES etc. formats as well as native CAD formats
 - Uni-directional connectivity
 - Approach II (Direct Connection)
 - ANSYS Direct CAD Interface
 - Bi-directional CAD connectivity



Pro/ENGINEER

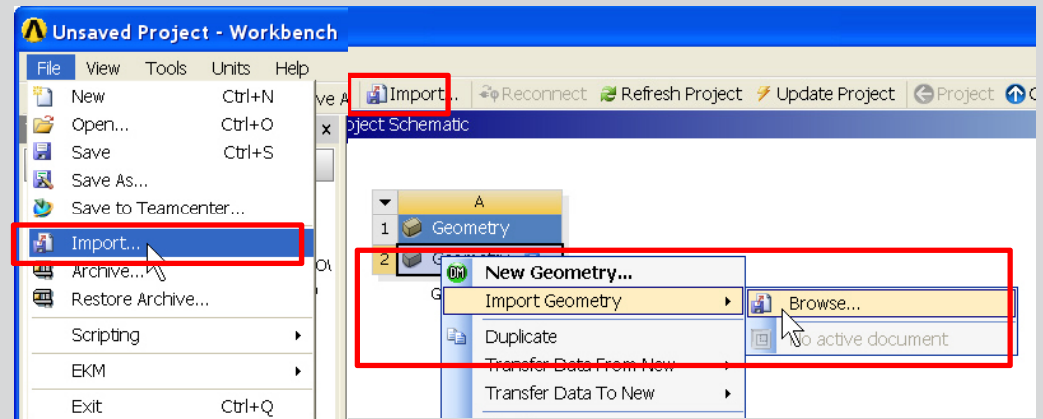


DM



CAD Connections: Approach I

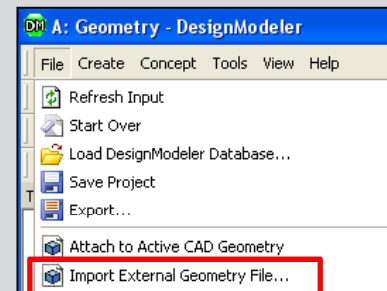
- Three ways to import file in WB
 - Import option on project page
 - File → Import
 - Geometry cell on project page



Geometry Import

CAD import in existing DM session

- Appends the geometry file to existing geometry in DM
- Multiple imports possible



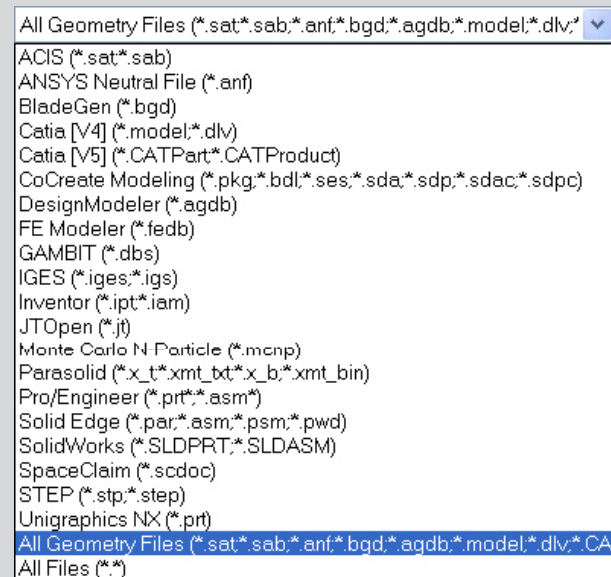
Import option in DM

CAD Connections: Approach I

- Import Options
 - Neutral file formats like STEP, IGES etc.
 - CAD Kernels like Parasolid, ACIS etc.
 - ANSYS Legacy formats like Bladegen (*.bgd), DM (*.agdb) etc.
 - CAD reader like UG, ProE, CATIA etc.

*Needs license for CAD & ANSYS
CAD interface*

- Please see documentation for more information



Geometry Import Options

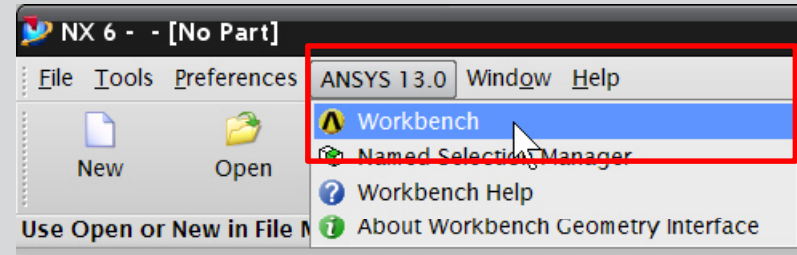
CAD Connections: Approach II

- Launch WB from CAD system
- Bi-Directional CAD Connectivity
- Can export parameters from CAD to WB
- Parameter change in CAD reflects in WB and vice versa

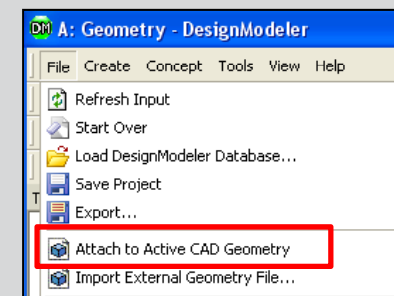
Bidirectional import from DM session

- Attach to Active CAD Geometry
 - Imports active CAD geometry in DM
 - Can attach only saved CAD sessions

- Parameter Key
- Prefix key for parameters to import
- By default the filter is set to DS
- If the filter is set to an empty string, all applicable entities will be imported as parameters



Direct CAD Connection in UG NX



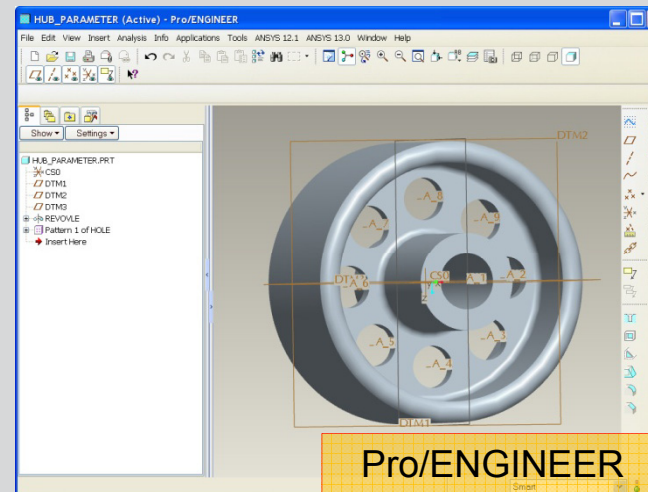
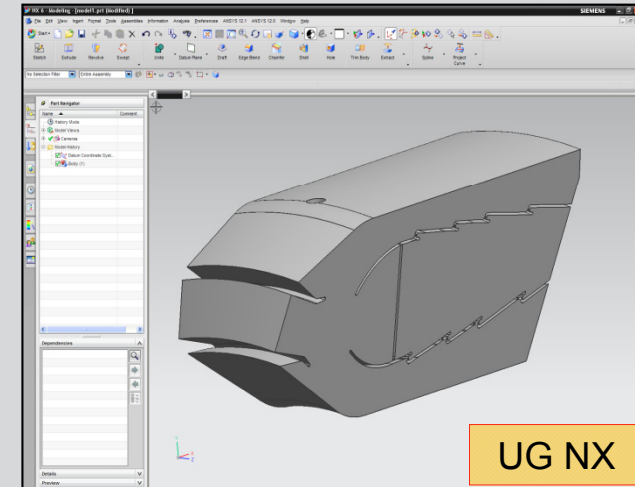
Attach option in DM

7	Basic Geometry Options	
8	Solid Bodies	☒
9	Surface Bodies	☒
10	Line Bodies	☐
11	Parameters	☒
12	Parameter Key	DS
13	Attributes	☐
14	Named Selections	☐
15	Material Properties	☐

Parameter Key

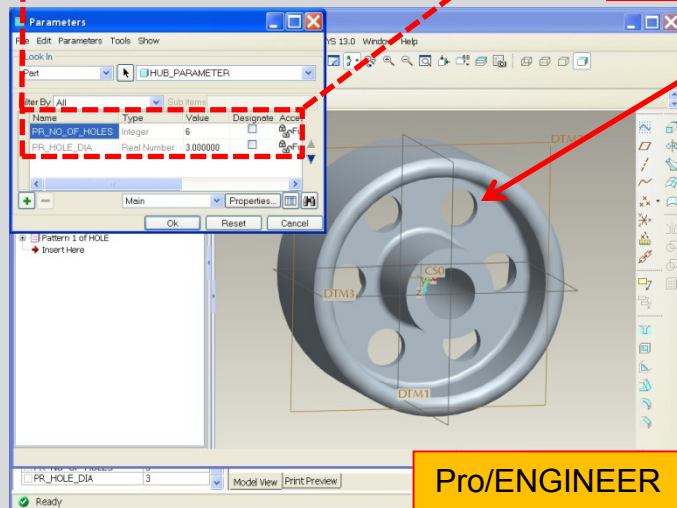
CAD Connections: Bi-Directional CAD

- Available for
- UG NX
- Pro/ENGINEER
- SolidWorks
- CoCreate Modeling
- Inventor
- Mechanical Desktop
- Solid Edge
- CATIA



Name	Type	Value	Designate	Access
PR_NO_OF_HOLES	Integer	6	☐	Fu
PR_HOLE_DIA	Real Number	3.000000	☐	Fu

Parameterized Hole Dia
and No of Holes

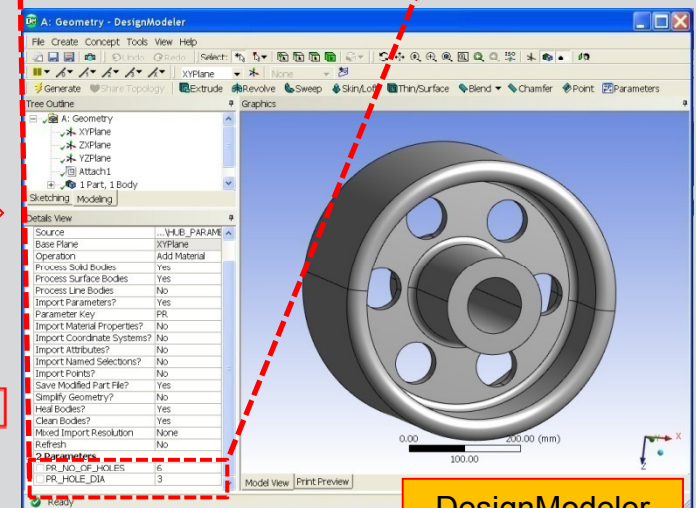


Parameters from
CAD to Workbench

Parameters from
Workbench to CAD

Pro/ENGINEER

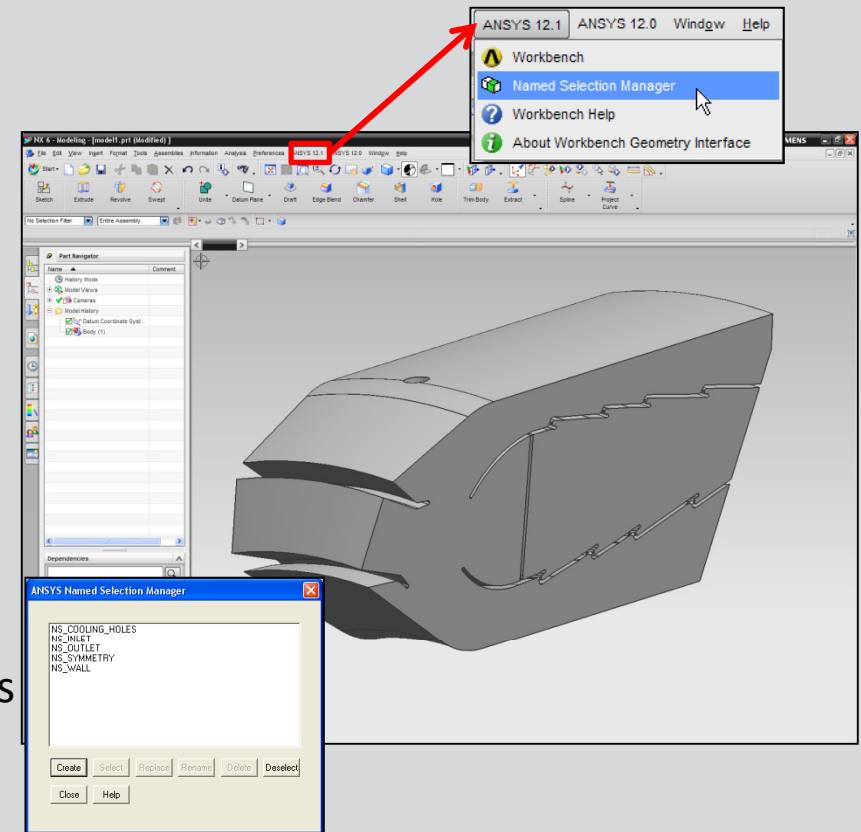
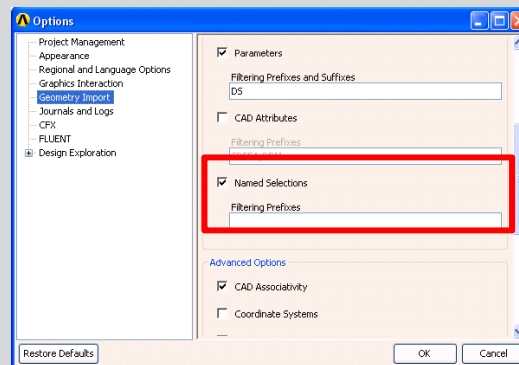
2 Parameters	
☐ PR_NO_OF_HOLES	6
☐ PR_HOLE_DIA	3



DesignModeler

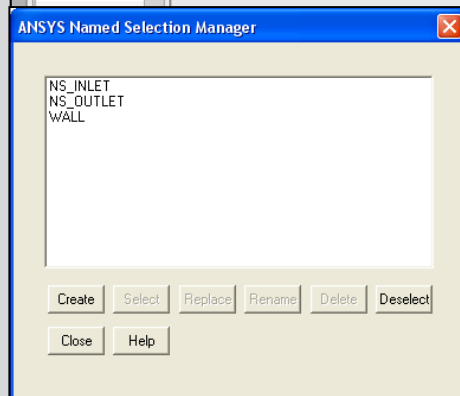
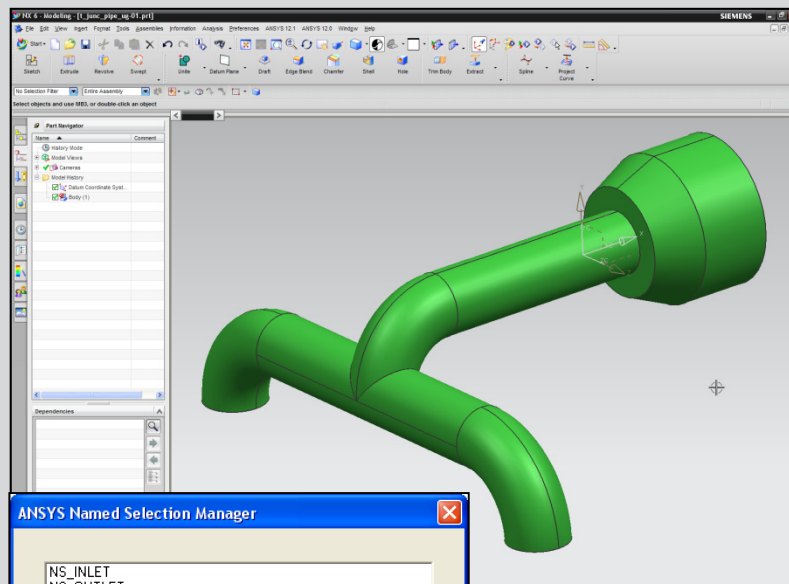
CAD Connections: Named Selection Manager

- Named selection
- Tag a boundary/face with a name
- Define in CAD & transfer to WB
- Define directly under WB
- Named Selection *filter* under WB
- By default the filter is set to NS
- Available if the “Import Named Selections” option is set to Yes
- If the filter is set to an empty string, all entities with name selection/boundary definition will be transferred

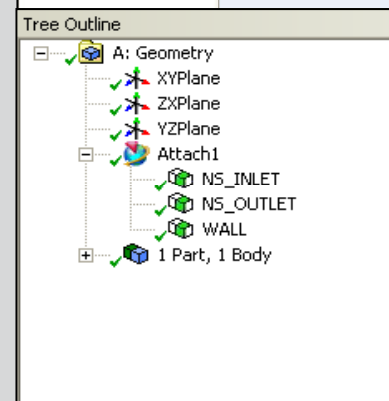
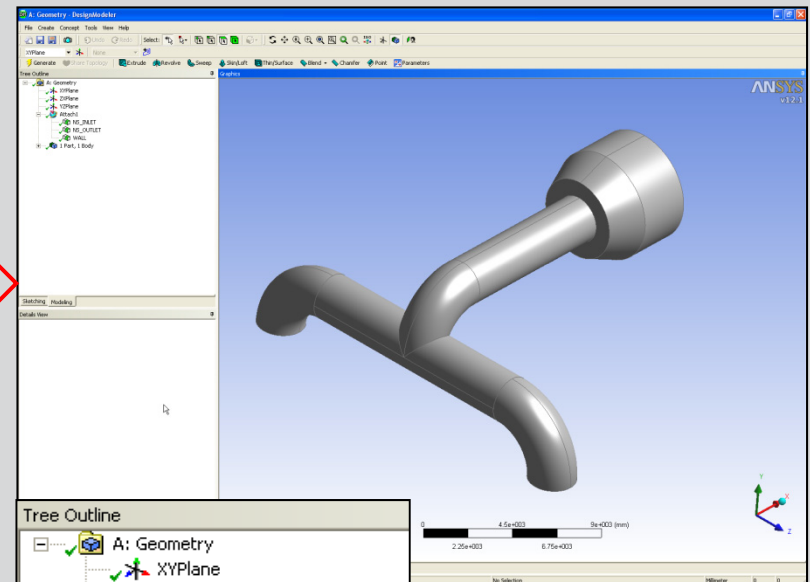


Named Selection
Manager in UG NX

CAD Connections: Named Selection Manager



Named Selection
defined in UG NX



Named Selection
imported in WB

What is Parameterization?

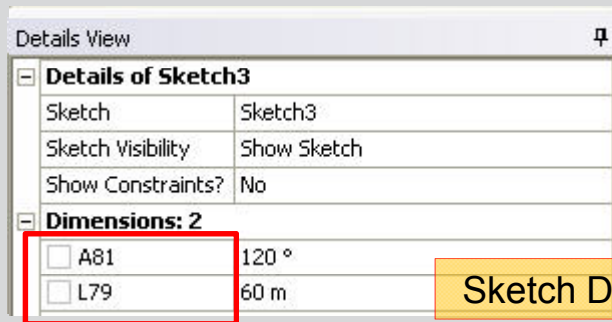
- Parameterization helps to execute a set of operations repeatedly with different set of values
 - Important features, such as diameter of cooling holes, camber etc can be made parametric
 - Very useful for analyzing various design points by modifying geometry/topology parameters
- DM supports sketch-to-3D approach to create parametric models in addition to accessing direct CAD parameters
 - Plane creation inputs, Sketch dimensions, 3D operation limiting values , etc can be treated as parameters
 - The parameters can be linked with each other through expressions

Dimensions from DM can be elevated to Workbench parameters

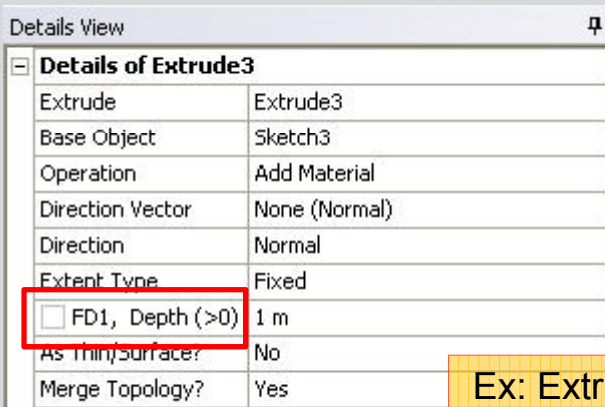
- No need to open DM to apply change
- Optimization possible

Parameters under DM

- Most of the DM operations can be parameterized
 - Any input under ‘details view’ with “□” sign as prefix can be parameterized
 - Toggle “□” sign to “D” to parameterize that particular input
- The parameters can be renamed



Sketch Details



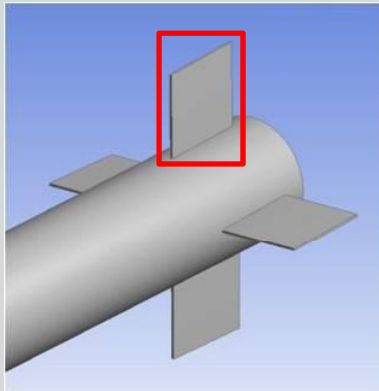
Ex: Extrusion



- Default Parameter Name Pattern:
 - (Feature Name) . (Dimension Reference)
- For example:
 - A dimension reference (A81) for a sketch created on XYPlane = XYPlane.A81
 - A dimension reference (FD1) for Extrude3 = Extrude3.FD1

Types of parameters in DM

- Geometric Parameters:



- Changes the dimensions/locations of a given feature
- Does not essentially change total number of entities in the model

→

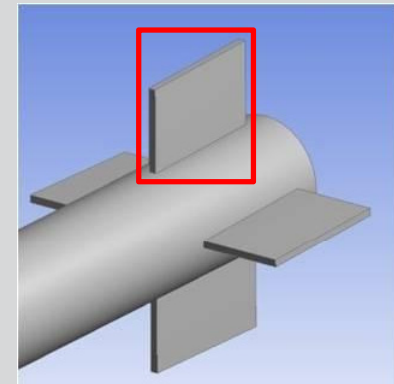
☐ ug_fin_thick	5
☐ ug_fin_len	200

Parametric Changes

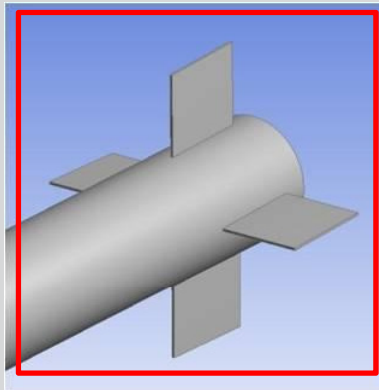
↓

☐ ug_fin_thick	15
☐ ug_fin_len	300

→



- Topological Parameters:



- Modifying the feature itself by adding /reducing new features on it
- Can essentially change total number of entities in the model

→

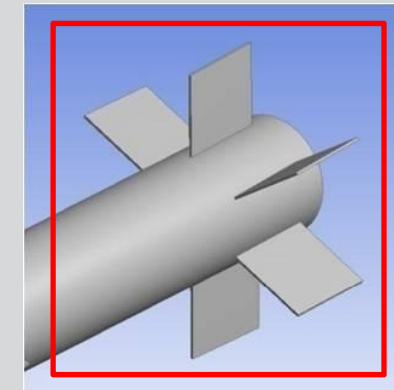
☐ ug_fin_number	4
--	---

Parametric Changes

↓

☐ ug_fin_number	6
--	---

→



- Parameters from CAD packages can be transferred to DM
- Filtering option for User Defined Parameters only
- Can maintain Bi-Directional CAD connectivity

Project Schematic

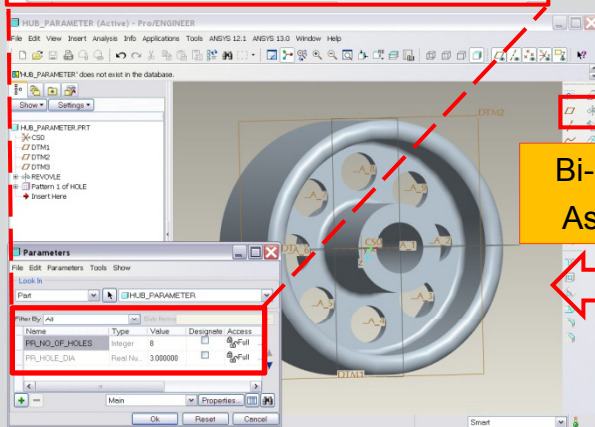
Properties of Schematic A2: Geometry

	A	B
1	Property	Value
2	General	
3	Component ID	Geom...
4	Directory Name	Geom
5	Geometry Source	
6	Geometry File Name	E:...
7	CAD Plug-In	Design...
8	Basic Geometry Options	
9	Parameters	☒
10	Parameter Key	PR
11	Attributes	☐
12	Named Selections	☐
13	Material Properties	☐

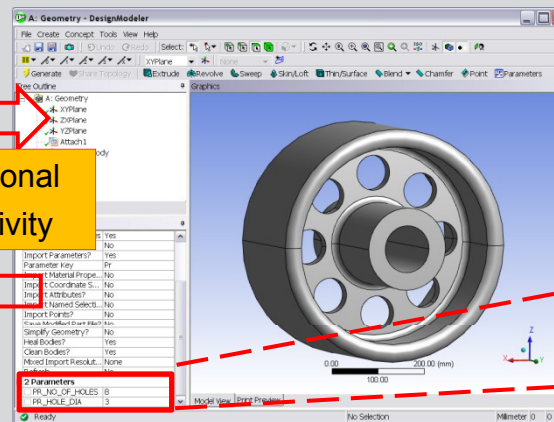
Geometry Property

CAD Parameters

Name	Type	Value	Designate	Access
PR_NO_OF_HOLES	Integer	8	☐	Full
PR_HOLE_DIA	Real Nu...	3.000000	☐	Full



Bi-Directional Associativity



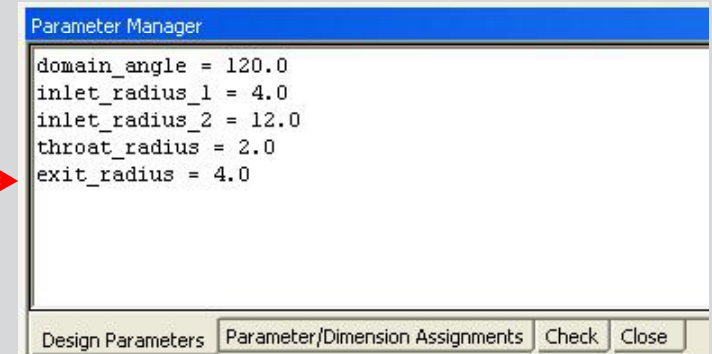
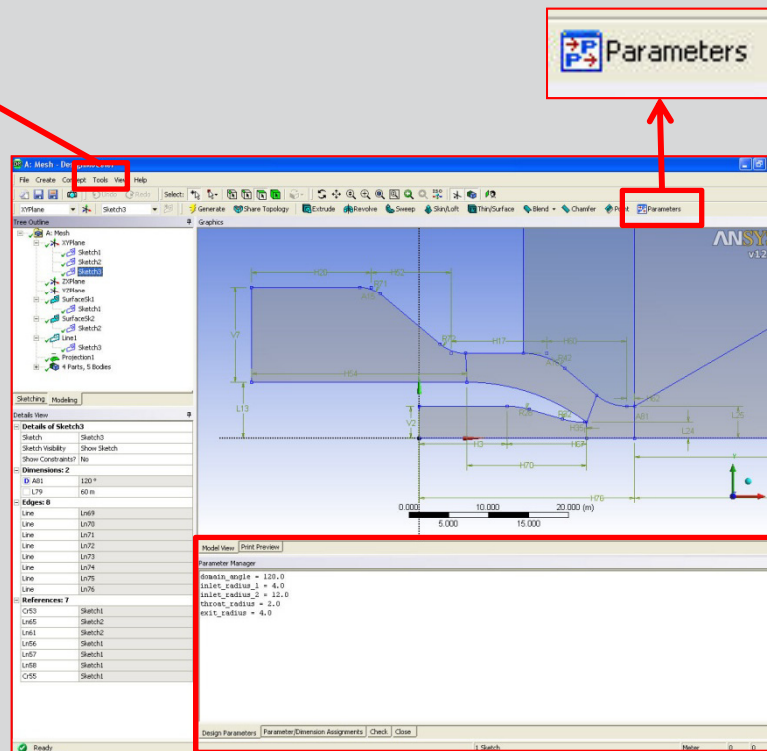
DM Parameters

2 Parameters

☐ PR_NO_OF_HOLES	8
☐ PR_HOLE_DIA	3

ANSYS[®] Parameter Manager

- When a parameter is defined, it is added under Parameter Manager
 - Can edit parameters



ANSYS® Parameter Manager

Parameter Manager contains tabs to create/edit parameters and its relations

- Independent variables are defined under “Design Parameters” tab
 - These parameters appear in Project Schematic of WB under “Parameter Set”
- Dependent variables are defined under “Parameter/Dimension Assignments” tab
 - Expressions can be used
- Expressions can be verified under “check” tab

The image displays three overlapping screenshots of the ANSYS Parameter Manager dialog box, each highlighting a different tab with a yellow callout box.

Design Parameters Tab: This tab is used for defining independent variables. The screenshot shows the following parameters:

```
domain_angle = 120.0
inlet_radius_1 = 4.0
throat_radius = 1.75
```

Parameter/Dimension Assignments Tab: This tab is used for defining dependent variables using expressions. The screenshot shows the following assignments:

```
XYPlane.L25 = 2*@throat_radius ## Exit Radius is 2 times of Throat Radius
XYPlane.L24 = @throat_radius ## This is comment
XYPlane.V7 = 3*@inlet_radius_1 ## Inlet Radius-2 is 3 times of Inlet Radius-1
XYPlane.V2 = @inlet_radius_1 ## This is comment
XYPlane.A81 = @domain_angle ## This is comment
```

Check Tab: This tab is used to verify the expressions. The screenshot shows the output of the DesignModeler Parameter/Dimension Assignments and Design Parameter Assignments.

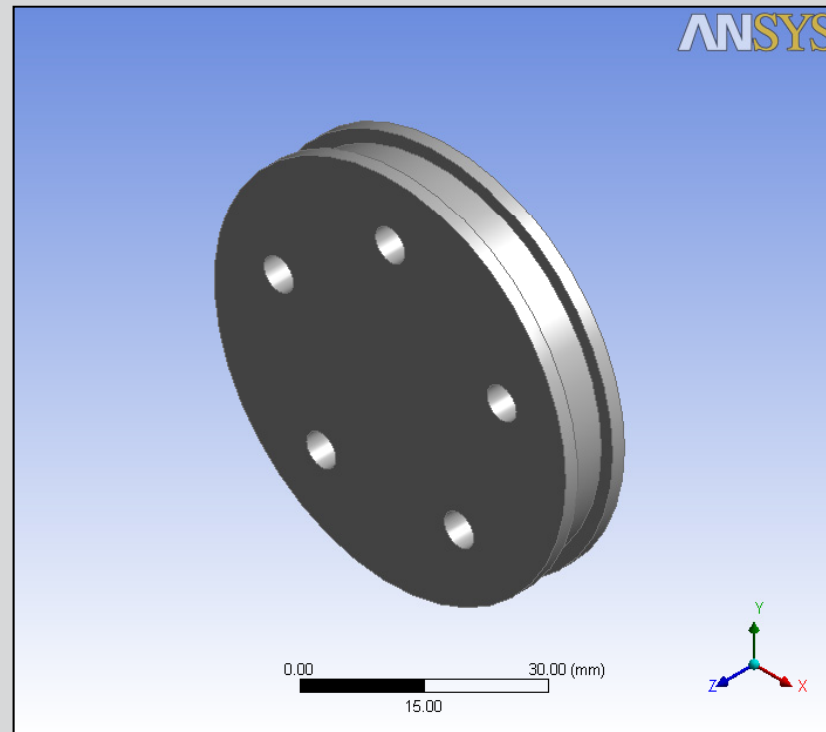
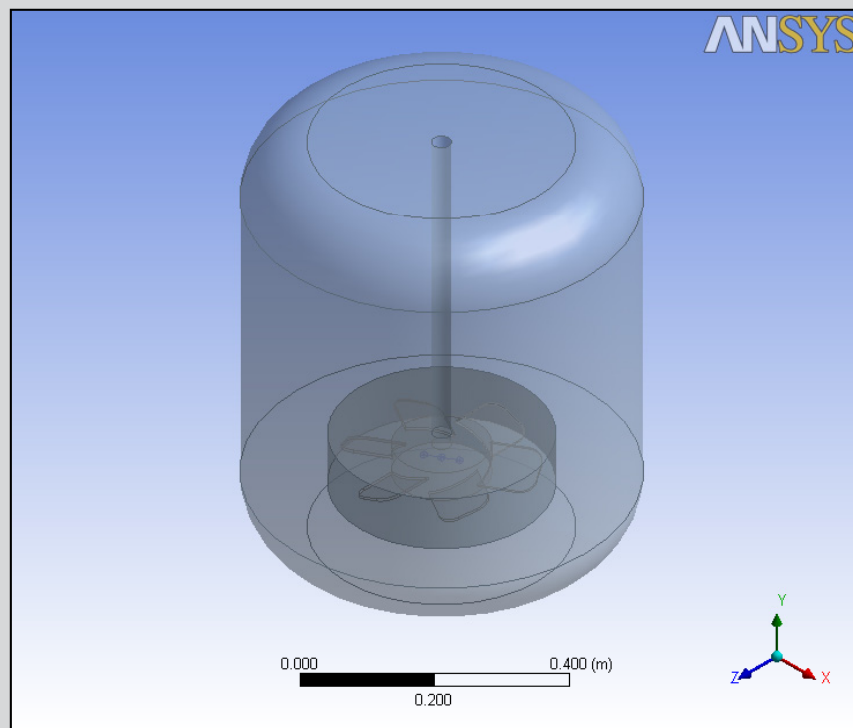
DesignModeler Parameter/Dimension Assignments Output

Plane Dim	Value	Expression	Comment
1 Plane Dim	4.0000	XYPlane.L25 = 2*@throat_radius	## Exit Radius is 2 times of Throat Radius
2 Plane Dim	2.0000	XYPlane.L24 = @throat_radius	## This is comment
3 Plane Dim	12.0000	XYPlane.V7 = 3*@inlet_radius_1	## Inlet Radius-2 is 3 times of Inlet Radius-1
4 Plane Dim	4.0000	XYPlane.V2 = @inlet_radius_1	## This is comment
5 Plane Dim	120.0000	XYPlane.A81 = @domain_angle	## This is comment

DesignModeler Design Parameter Assignments Output

Plane Dim	Value	Expression	Comment
1	120.0000	@domain_angle	
2	4.0000	@inlet_radius_1	
3	2.0000	@throat_radius	

Workshops 5 (Applications) 5a – Parameterized Mixing Tank or 5b – Parameterized Pulley



Appendix

Contents

- Pre-requisites for CAD Connections
- CAD Connections: Advanced Geometry options
- Gambit Reader

Pre-requisites for CAD Connections

- For all CAD packages
 - CAD correctly installed and licensed
 - Correct ANSYS Inc. license
- For CATIA
 - Compatible version of CATIA V5, CADNexus/CAPRI Gateway V3.08, IBM LUM 4.6.8 configured with a CATIA V5 (MD2, HD2, or ME2) license
- For Pro/ENGINEER
 - Parts must reside on a local or mapped drive
 - Filenames must contain all lowercase letters on the Linux platform
- For UG NX
 - Avoid setting Reader Save Part File to Yes on Linux platforms if a CAD file is open
 - NX 5.0.6 or higher is recommended for importing models containing spot welds
 - All bodies must be within a 1000 x 1000 x 1000 meter cube, centered about the origin of the absolute coordinate system



For more information about license requirement, please see the documentation

CAD Connections: Advanced Geometry options

- Analysis Type
 - To set the geometry for 2D or 3D simulation
- Use Associativity
 - To allow CAD associativity
- Import Coordinate Systems
 - Can import coordinate system from CAD
- Import Work Points
 - Can import work points defined in CAD
- Reader Mode Saves Updated File
 - To save CAD file at the end of update process
- Import Using Instances
 - To import part instances from CAD
- Smart CAD Update
 - To speed up refresh of modified parts
- Enclosure and Symmetry Processing
 - To turn ON/OFF enclosure and symmetry selections
 - Automatically creates *named selection* if turned ON
- Mixed Import Resolution
 - To import parts with mixed dimensions

12	Advanced Geometry Options	
13	Analysis Type	3D 
14	Use Associativity	☒
15	Import Coordinate Systems	☐
16	Import Work Points	☐
17	Reader Mode Saves Updated File	☐
18	Import Using Instances	☒
19	Smart CAD Update	☐
20	Enclosure and Symmetry Processing	☒



For more information about Advanced Geometry Options and applicability, please see the documentation under “Advanced Geometry options”

Legacy model from Gambit can be imported in DesignModeler

- Reads Real (ACIS) geometry from a Gambit database
- Does not include reading meshing information
- Users can take the geometry in DM for editing
- If no editing is needed the model can be taken directly into Meshing

