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04/24/2019



Overview

- Introduction
- Parametric Modeling
- Engineering Knowledge Language
- Questions







Introduction - About me



Parametric Modeling - What is Parametric Modeling?

• Properties of Design are defined by changeable parameters



 $\leftarrow \textit{Knowledge Workbench}$

Formulas: Part13			? ×
Filter On Part13 Filter Name : * Filter Type : All Double click on a parameter to edit it			Import
Parameter	Value	Formula	Active 🔺
'Prism Length'	10.0000in		
`Prism Width`	5.0000in		
'Prism Depth'	6.0000in		
Relations\Formula.1\Activity	true		
Relations\Formula.2\Activity	true		III
Relations\Formula.3\Activity	true		
`Part13\Part Number`	Part13		
Edit name or value of the current parameter			
Prism Length	1	10.0000in	
New Parameter of type Length With Delete Parameter	Single Value	• • OK	Add Formula Delete Formula Apply Cancel



Parametric Modeling - Linking Design Constraints to Parameters

Constraints can be defined by formulas set equal to parameter values



Members of Parameters

Renamed parameters

Length

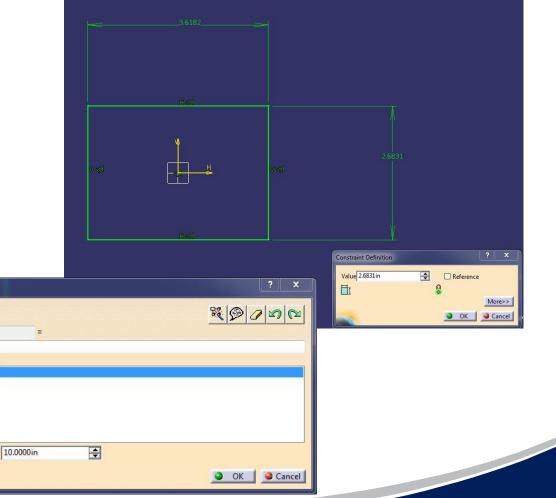
Members of All

Prism Width

Prism Depth

Formula Editor : PartBody\Sketch.1\Length.7\Length

PartBody\Sketch.1\Length.7\Length





`Prism Length` Dictionary

Part Measures

Prism Length

Generative functions

Analysis operators Axis Systems Constructor: Circle Constructors

Parametric Modeling - Linking Design Constraints to Parameters

Constraints can be defined by formulas set equal to parameter values

Pad Definition	? _ X _				
First Limit					
Туре:	Dimension 🔹				
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Limit:	No selection				
Thick Reverse Side					
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Reverse Direction					
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ок ок	Cancel Preview				

\leftarrow An indicator that this constraint was defined with a formula



Parametric Modeling - Relations Folder

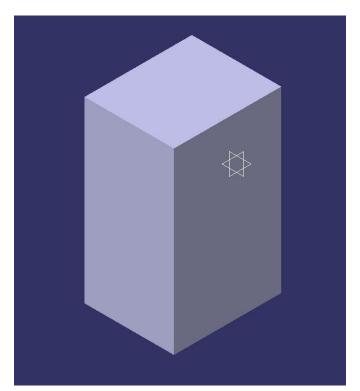
• All formulas are stored in the relations folder





Parametric Modeling - Final Product

• The final product is the same, but changing the design becomes much easier





User Defined Features are Packaged Sets of Geometry

E.g. a sphere, a rivet, a spar, etc.

 Knowledge Patterns are pieces of code that help automate the design process

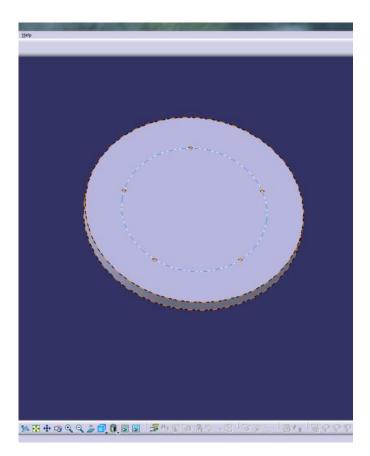


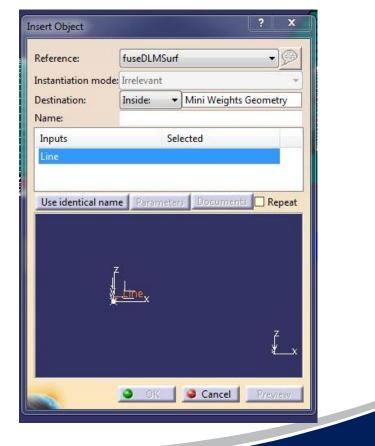




Training - User Defined Features (UDFs)

• UDFs can be instantiated manually







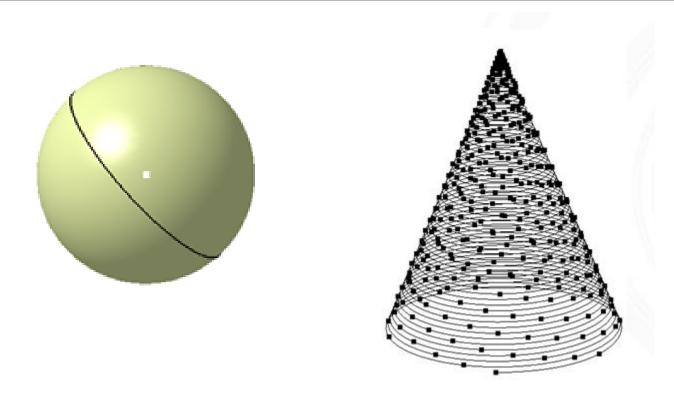
Training - User Defined Features (UDFs)

Name :	Add Remove Paste in editor	
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	Y = (rConstant* iIndex* (sin(iIndex)))) iCounter = Relations Knowledge Pattern.1\Points' ->Size() + 1 oPoint = CreateOrModifyDatum("Point", Points, 'RelationsKnowledge Pattern.1\Points', iCounter) oPoint = point(X * 1in, Y * 1in, 1in * iIndex)	
	Counter = `Relations'Knowledge Pattem.1\Spheres' ->Size() + 1 oUDF = CreateOrModifyTemplate(TestCatalog Sphere", Spheres, `Relations!Knowledge Pattern.1\Spheres`, iCounter) oUDF->SetAttributeObject("Select_Point_1", oPoint) oUDF ->SetAttributeDimension("Sphere_Radius", 4in, "LENGTH") EndModifyTemplate(oUDF)	
	reateQrModifyDatum("Curve", Points, 'RelationsWnowledge Pattern:1)Curve', 1) Nine("RelationsWnowledge Pattern:1)Points')	_

UDFs can also be instantiated with the use of a knowledge pattern



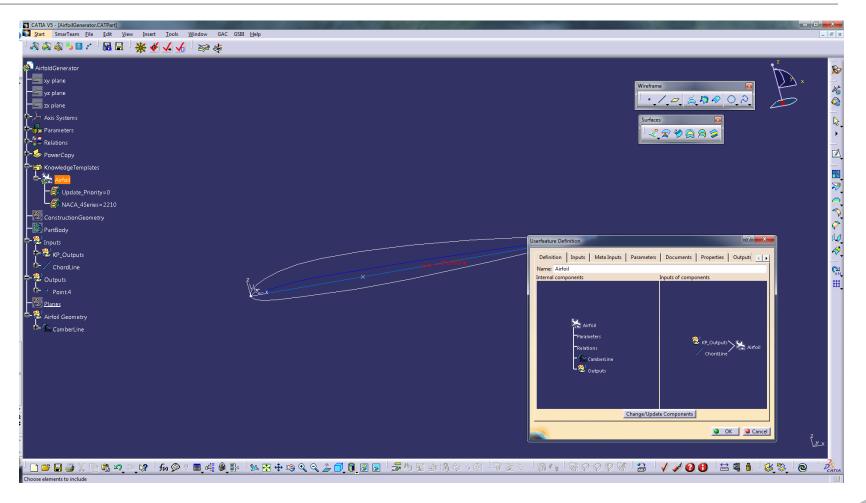
Training - User Defined Features (UDFs)



 UDFs can also be instantiated with the use of a knowledge pattern



Training - Putting a Knowledge Pattern Inside of a UDF



Knowledge pattern outputs can also be put into UDFs



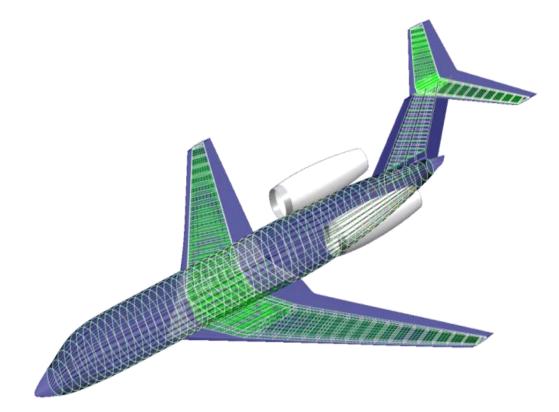
Training - Final Outcome

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	400	25	6	3	0.5	8	0.15	0.85	
1	400	25	10	5	0.5	8	0.15	0.85	
	400	25	10	3	0.3	8	0.15	0.85	
0	400	25	10	3	0.5	12	0.15	0.85	
	400	25	10	3	0.5	8	0.25	0.85	
	400	25	10	3	0.5	8	0.15	0.75	

 Used knowledge patterns and UDFs to create parameter-based wing design



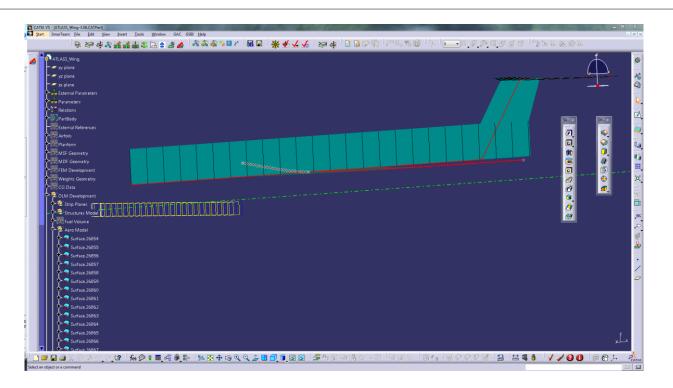
Automated Top Level Aircraft Structural Sizing Tool (ATLASS) - Overview



 ATLASS is a weight optimization tool that bridges the gap between preliminary design and detailed design



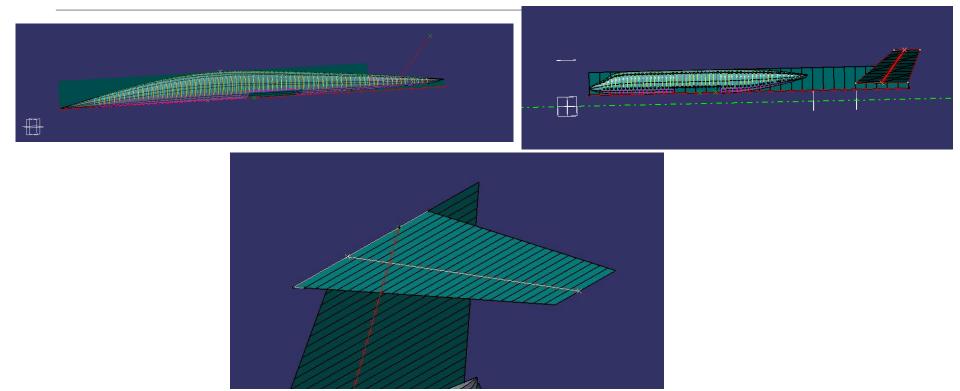
Fuselage Doublet Lattice Model (DLM)



- Creates Panelized weights to be used in determining aerodynamic loads
- Initially used UDFs, switched to creating geometry entirely from code for consistency with other parts of plane



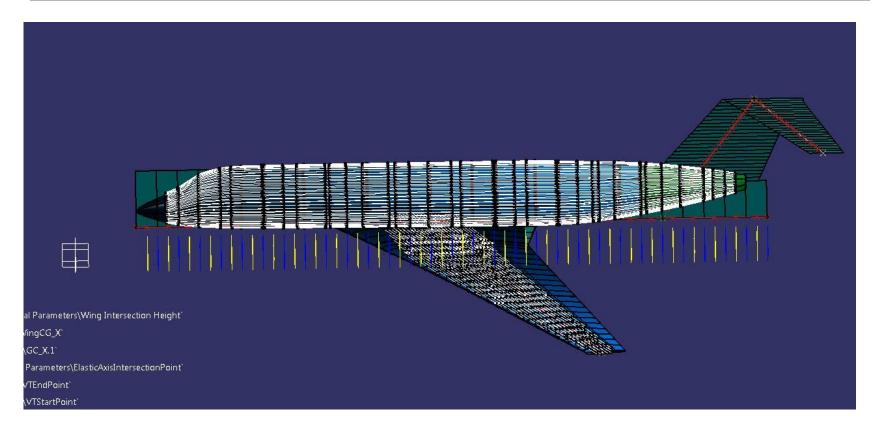
Fuselage DLM (continued)



Had trouble making it work with different design table configurations and different parts of aircraft



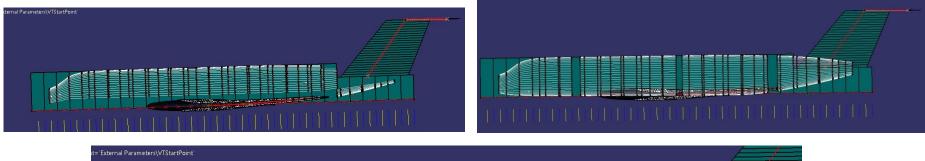
Mass Properties - Creation



- Switched from panel UDFs to panels created from code to make panelizing weights easier
- Divides structural weight contributions from fuselage surfaces and stringers into panels



Mass Properties - Optimizing Code





- Code initially took 1-2 hours to run, so attempts were made to decrease required iterations
- Stringers were split into multiple lists so that code would not have to iterate through 1000 stringers each run through loop
 - Stringers were organized based on fraction of list, but this was unsuccessful
 - Stringers were organized based on fraction of fuselage length, this is in progress, but will likely be successful



Final Project Idea

ATLASS for cars

- Combine personal interest with knowledge acquired from this semester













Choices For Next Rotation

- 1. Service Engineering
- 2. Systems Test Design Engineering Mechanical
 - 3. Flight Test Engineering
 - 4. Propulsion and Thermodynamics

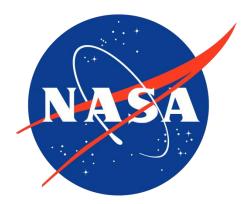




Plans at Purdue

I have a few major goals for my time at Purdue:

- 1. Get a co-op at a reputable company Check
- 2. Do research NASA Extraterrestrial Habitat
- 3. Study abroad France, Fall 2020



4. Work at the Innovation and Design Center - Summer 2019







Thank You!

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