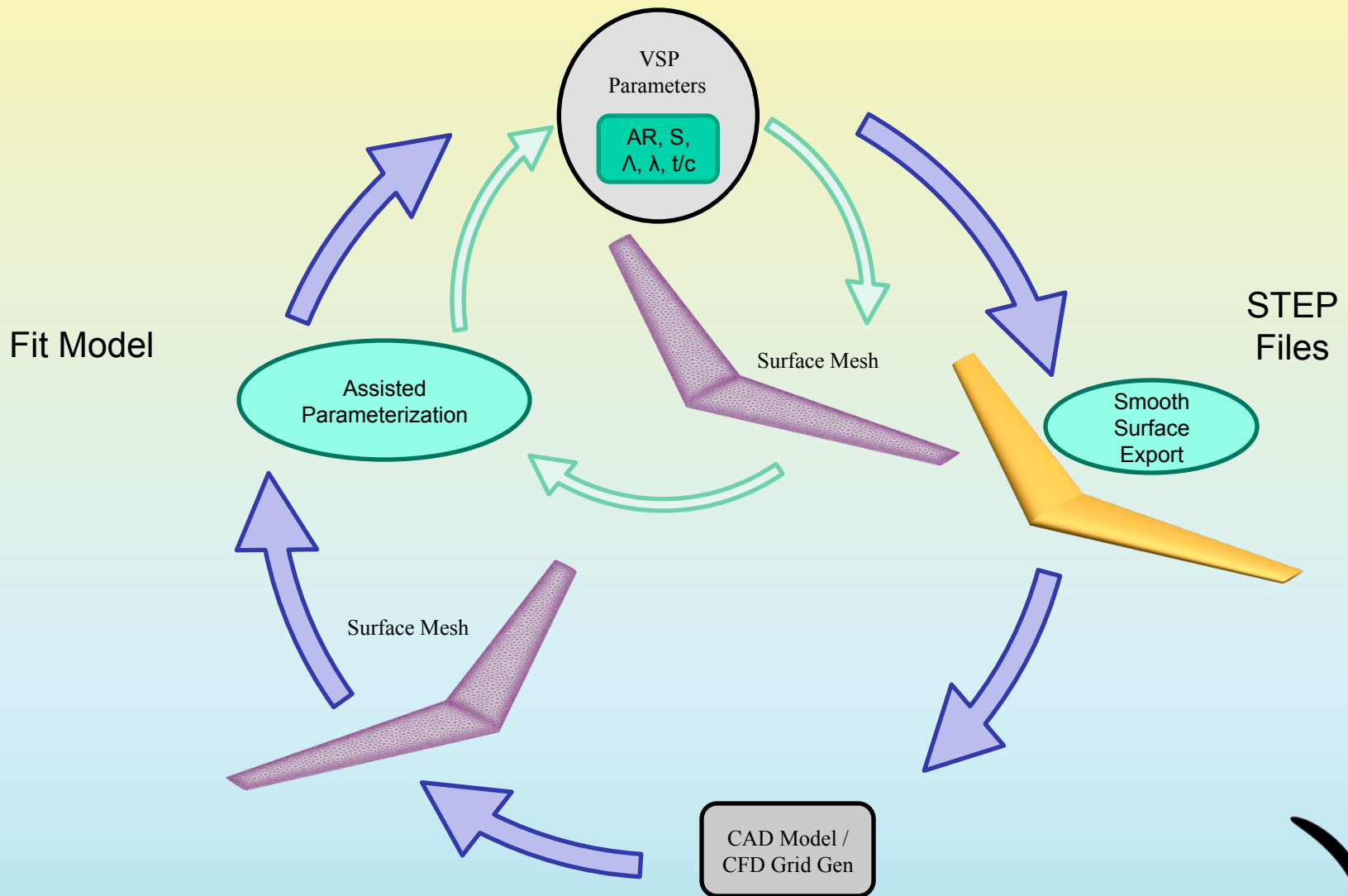


Fit Model Preview (Coming SciTech 2015)

Rob McDonald – Cal Poly

VSP Workshop
August 22, 2014

VSP To CAD Interoperability



Fit Model Use Case

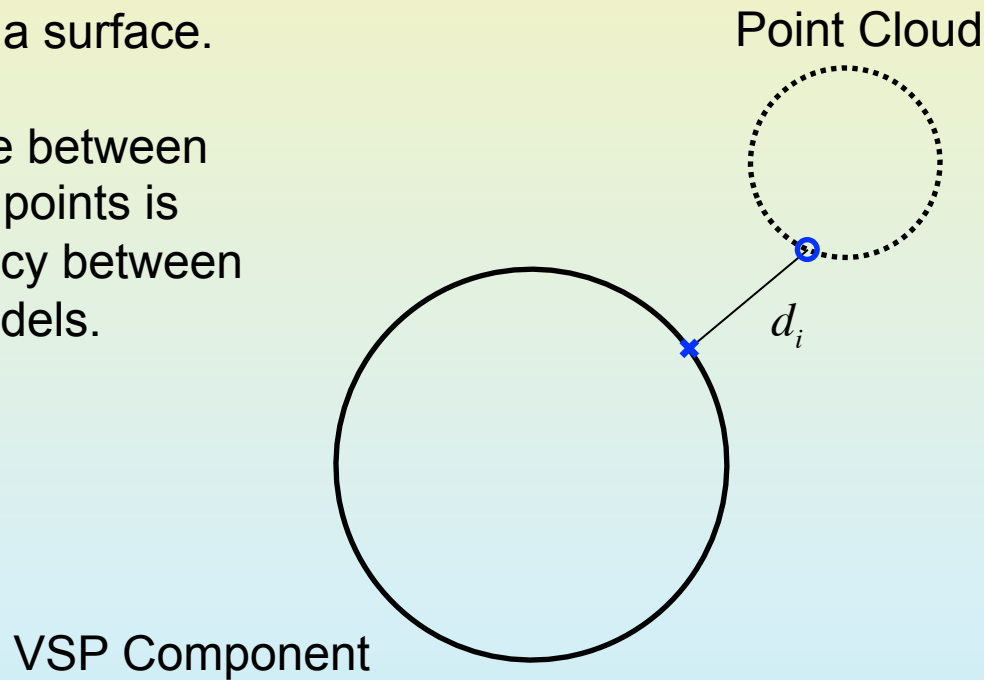
- Reverse engineer physical object
 - Laser scan
 - Aircraft, Part, Tunnel model, etc.
- Interoperate with legacy model
 - CAD model
 - Surface mesh
- Baseline for design study
 - Match model
 - Gain parameterization
- Do not want a 'dumb' fit
 - OpenVSP Parameters
 - Match 'native' model in creation



Target Point

Pairing of individual point in cloud to a point on a surface.

Distance between paired points is discrepancy between models.



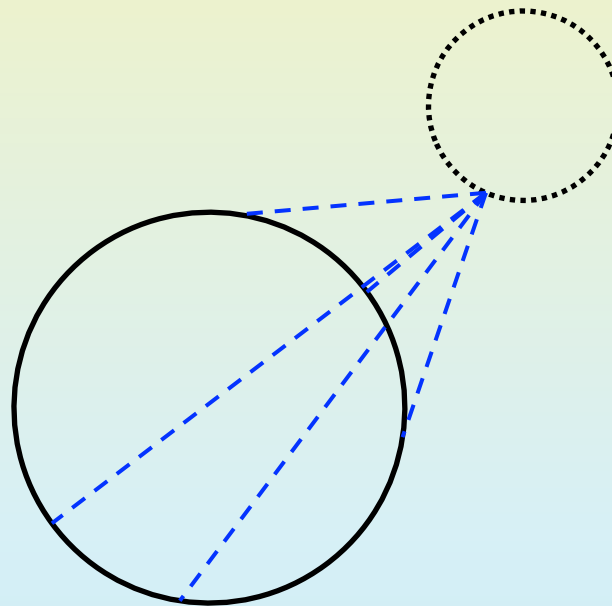
Target Point Mode

Where on surface
does target
point pair?

Is that point fixed
or can it move?
(minimum distance)

Surface defined
in U, W parameters.

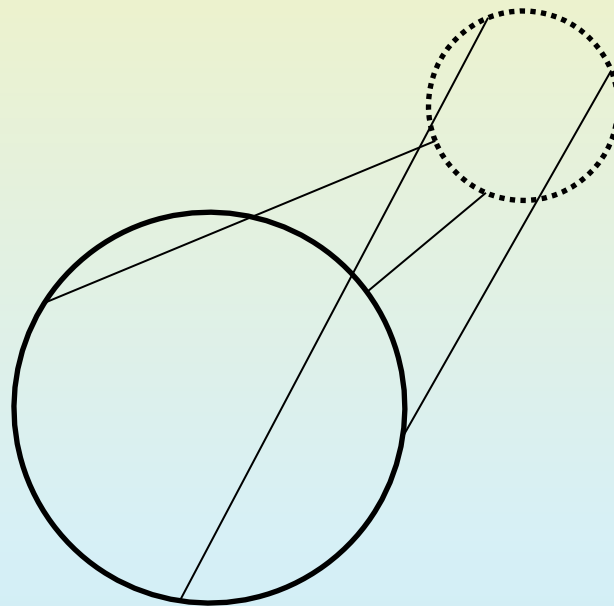
Target points may
be fixed or free in each.



Distance Metric

Root of
sum of distances
squared.

$$D = \sqrt{\sum_N (d_i)^2}$$

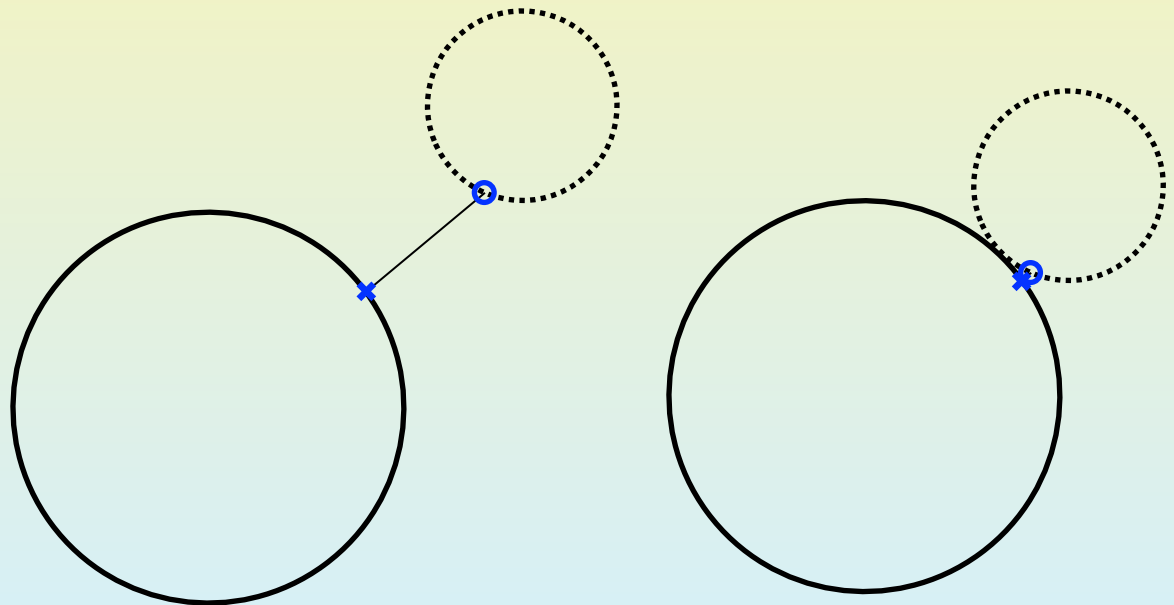


Prevalent Local Minima

'Free' target points
subject to optimization.

Minimum distance
subproblem prone
to local minima.

Offer both
Newton's Method
(Refine UW) and
robust global
(Search UW)
optimization.



Fit Model GUI

Fit Model

Pick Points | Pick Vars | **Fit Model**

Point Selection

Num Selected 0

Select One | Hide Selection
 Select Group | Hide Unselected
 Select All | Hide All
 Select None | Show All

Target Points

GEOM	X	Y	Z	U	Type	W	Type
PodGeom	0.00	0.00	0.00	0.00	fix	0.00	fix
PodGeom	10.00	0.00	0.00	1.00	fix	1.00	fix

Geom: 0_PodGeom

Fix Free U
 Fix Free W

Add Target | Delete Target | Clear Target

Optimizer Control

Search UW | Refine UW
 Update Distance | Fit
 Distance Metric 0.000000

Fit Model

Pick Points | **Pick Vars** | Fit Model

Variable

Container: 2-PodGeom
 Group: Design
 Parm: Length

Add Variable | Delete Variable | Clear Variables

Variable List

COMP_A	GROUP	PARM
PodGeom	Design	Length
PodGeom	XForm	X_Location
PodGeom	XForm	Y_Location
PodGeom	XForm	Y_Rotation
PodGeom	XForm	Z_Location
PodGeom	XForm	Z_Rotation

Optimizer Control

Search UW | Refine UW
 Update Distance | Fit
 Distance Metric 0.000000

Fit Model

Pick Points | Pick Vars | **Fit Model**

PodGeom

Length	<input type="text" value="16.667"/>
X_Location	<input type="text" value="8.810"/>
Y_Location	<input type="text" value="-3.333"/>
Y_Rotation	<input type="text" value="28.571"/>
Z_Location	<input type="text" value="4.524"/>
Z_Rotation	<input type="text" value="-25.357"/>

Optimizer Control

Search UW | Refine UW
 Update Distance | Fit
 Distance Metric 0.000000



Pick Points

The screenshot shows a software window titled "Fit Model" with three tabs: "Pick Points", "Pick Vars", and "Fit Model". The "Pick Points" tab is active. It contains a "Point Selection" section with a "Num Selected" field set to 0 and buttons for "Select One", "Select Group", "Select All", "Select None", "Hide Selection", "Hide Unselected", "Hide All", and "Show All". Below this is a "Target Points" table with columns for GEOM, X, Y, Z, U, Type, W, and Type. The table lists two rows of "PodGeom" data. At the bottom of the table is a "Geom" dropdown menu set to "0_PodGeom". Below the dropdown are two rows of target controls, each with "Fix" and "Free" checkboxes, a variable name ("U" and "W"), a slider, and a value field set to "1.000". There are also "Add Target", "Delete Target", and "Clear Target" buttons. The bottom section is "Optimizer Control" with buttons for "Search UW", "Refine UW", "Update Distance", and "Fit". A "Distance Metric" field shows "0.000000".

GEOM	X	Y	Z	U	Type	W	Type
PodGeom	0.00	0.00	0.00	0.00	fix	0.00	fix
PodGeom	10.00	0.00	0.00	1.00	fix	1.00	fix

Point Selection

Target Point List

Target Component

Target Mode Control

Add/Delete Target Points

Update Target Pts

Fit



Pick Variables

Parameter Selection

Manipulate
Variable List

Variable List

The screenshot shows a software dialog box titled "Fit Model". It has three tabs: "Pick Points", "Pick Vars" (which is selected), and "Fit Model". Below the tabs, there are three fields for "Variable" selection: "Container" (set to "2-PodGeom"), "Group" (set to "Design"), and "Parm" (set to "Length"). Each field has a dropdown arrow. Below these fields are three buttons: "Add Variable", "Delete Variable", and "Clear Variables".

Below the buttons is a "Variable List" table with the following data:

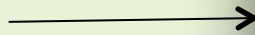
COMP_A	GROUP	PARM
PodGeom	Design	Length
PodGeom	XForm	X_Location
PodGeom	XForm	Y_Location
PodGeom	XForm	Y_Rotation
PodGeom	XForm	Z_Location
PodGeom	XForm	Z_Rotation

At the bottom of the dialog box is an "Optimizer Control" section with four buttons: "Search UW", "Refine UW", "Update Distance", and "Fit". Below these buttons is a "Distance Metric" field with the value "0.000000".



Manual Fit Model

Manual
Variable Controls



PodGeom		
Length	<input type="text"/>	16.667
X_Location	<input type="text"/>	8.810
Y_Location	<input type="text"/>	-3.333
Y_Rotation	<input type="text"/>	28.571
Z_Location	<input type="text"/>	4.524
Z_Rotation	<input type="text"/>	-25.357

Optimizer Control	
Search UW	Refine UW
Update Distance	Fit
Distance Metric	0.000000



Demo

Questions?

