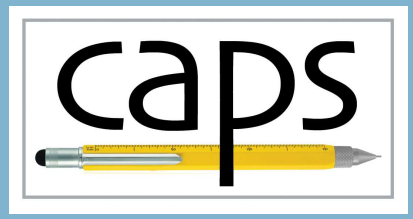
Computational Aircraft Prototype Syntheses



Training Session 4
Geometry Analysis Views
ESP v1.18

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Overview

- Multi-analysis Models
  - wing4.csm Example
  - Geometric Analysis Views
  - Attribution Views
  - Coupled Analysis View

- Suggested Exercises

Multi-analysis Models

Single-analysis Models

- Only single analysis geometric models considered so far:

f118-C.csm	$\rightarrow$	masstranAIM
avlPlaneVanilla.csm	$\rightarrow$	avlAIM
naca.csm	$\rightarrow$	xfoildAIM

- Different parameterizations for each model

Multi-analysis Models

- Single model parameterizations for multi-analysis

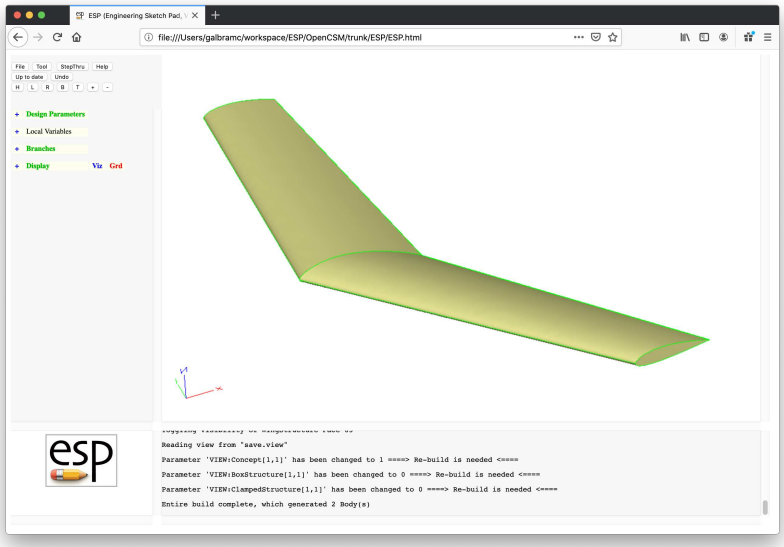
		avlAIM
wing4.csm	$\rightarrow$	su2AIM
		astrosAIM

- Each analysis requires different geometric representation

Multi-analysis Model Example: wing4

ESP/wing4.csm

```
# Design Parameters for OML
DESPMTR   wing:area       10.0      # wing area
DESPMTR   wing:aspect     6.00      # aspect ratio
DESPMTR   wing:taper      0.60      # taper ratio
DESPMTR   wing:sweep      20.0      # deg (of leading edge)
DESPMTR   wing:thickr     0.12      # thickness ratio at root
DESPMTR   wing:camberr    0.06      # camber    ratio at root
DESPMTR   wing:thickt     0.16      # thickness ratio at tip
DESPMTR   wing:cambert    0.02      # camber    ratio at tip
DESPMTR   wing:alphat    -5.00      # setting angle   at tip
DESPMTR   wing:dihedral   4.00      # deg
DESPMTR   wing:xroot      0.00      # xloc at root LE
DESPMTR   wing:yroot      0.00      # yloc at root LE
DESPMTR   wing:zroot      0.00      # zloc at root LE
```



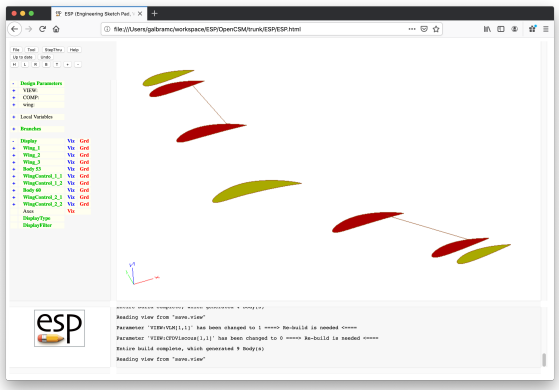
Geometric Analysis Views

- Views construct analysis specific geometry
- Implemented as user-defined components (UDCs)

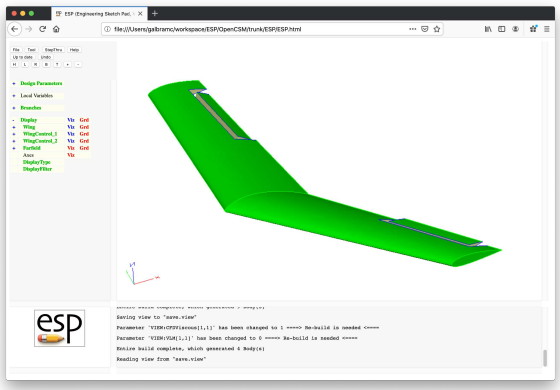
		viewVLM.udc	→	avlAIM
wing4.csm	→	viewCFDViscous.udc	→	su2AIM
		viewStructure.udc	→	astrosAIM

- Analysis geometry attributed with `CAPS` attributes

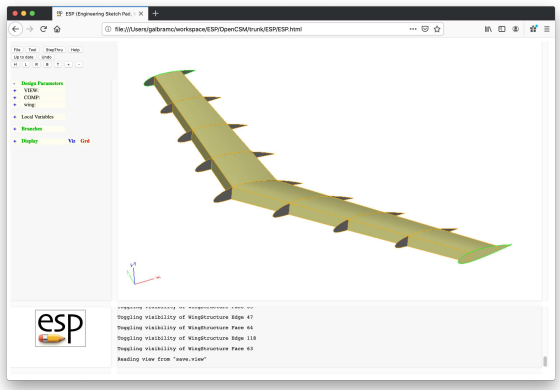
ESP/wing4.csm



ESP/viewVLM.udc



ESP/viewCFDViscous.udc



ESP/viewStructure.udc

Dissection of `wing4.csm`

- Switches for VIEWs

```
# define the views
CFGPMTR   VIEW:Concept          1
CFGPMTR   VIEW:VLM              0
CFGPMTR   VIEW:CFDInviscid      0
CFGPMTR   VIEW:CFDViscous       0
CFGPMTR   VIEW:ClampedStructure 0
```

- Switches for COMPonents

```
# define components to be used
CFGPMTR   COMP:Wing           1
CFGPMTR   COMP:Control        0
```

- Definition of Design Parameters

```
# Design Parameters for OML
DESPMTR   wing:area      10.0      # wing area
DESPMTR   wing:aspect    6.00      # aspect ratio
DESPMTR   wing:taper     0.60      # taper ratio
```

- Call to `capsHeader` (initialize "make" variables)
- Construct `WingOml` (with attributes)
- Call to `capsViews`

Attributes on WingOml

Component, Tag, and Index Attributes

- FACEs
  - tagComp with value $leftWing or $riteWing
  - tagType with value $tip, $upper, $lower, or $trailingEdge
  - tagIndex with value $1 or $2
- EDGEs
  - tagComp with value $leftWing or $riteWing
  - tagType with value $root, $leadingEdge or $trailingEdge

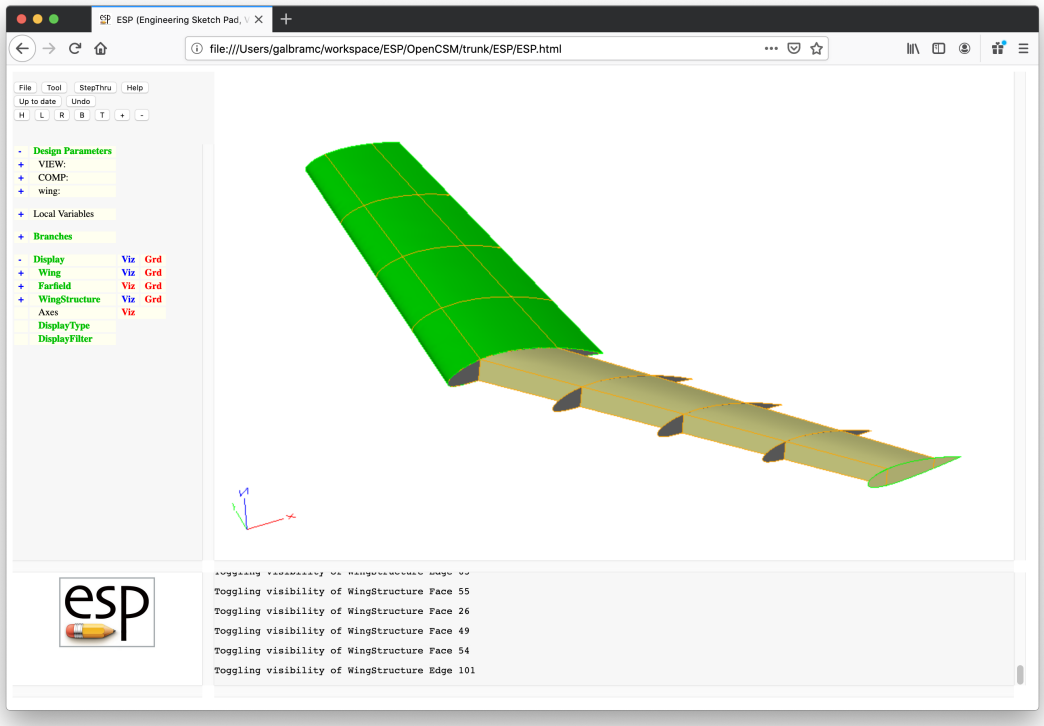
CAPS Attributes

- Attributes used in views to select entities for CAPS attribution
- WingOml attributes simplify otherwise complex selections

Coupled Analysis

- Coupled analysis requires multiple analysis geometries simultaneously
- Achieved with multiple active views

```
CFGPMTR   VIEW:CFDInviscid        1
CFGPMTR   VIEW:ClampedStructure   1
```



Create your own Views

- Training UDC views are flexible, but not universal
  - Designed for ESP/wing*.csm and ESP/transport.csm
- Views are a powerful method for organizing multi-analysis geometry
  - Views should be customized for projects
- More details about the views in `ESP` training session10

Suggested Exercises

Transport Views

- Use the ESP GUI (not editor) with ESP/transport.csm to:
  - First enable

```
COMP:Pylon     1
COMP:Pod       1
COMP:Control   1
```

  - Then toggle each view one at a time
- Note: VIEW:BoxStructure can only be enabled in combination with VIEW:SupportStructure or VIEW:ClampedStructure

Suggested Exercises Cont.

wing3 Views

- Using the ESP GUI (not the editor), toggle the views:

```
VIEW:Concept              0
VIEW:SupportStructure     1
VIEW:BoxStructure         1
```

- Turn on the Viz for the Nodes
- Use the ESP GUI DisplayFilter to inspect the attribute names:
  - `capsGroup`
  - `capsConnect`
  - `capsConnectLink`
  - `capsLoad`
  - `capsIgnore`

- Create your own (optionally share it `galbramc@mit.edu`)