Computational Aircraft Prototype Syntheses

Training Session 4
Geometry Analysis Views
ESP v1.19

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- 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	$\rightarrow$	xfoilAIM

- 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

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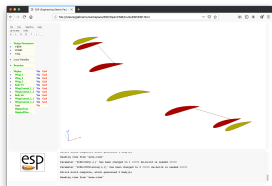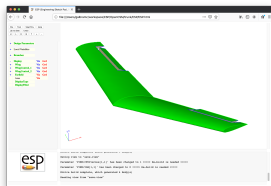
Geometric Analysis Views
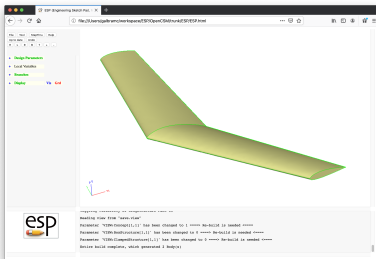
- Views construct analysis specific geometry
- Implemented as user-defined components (UDCs)

		viewVLM.udc	$\to$	avlAIM
wing4.csm	$\to$	viewCFDViscous.udc	$\to$	su2AIM
		viewStructure.udc	$\to$	astrosAIM

- Analysis geometry attributed with `CAPS` attributes

ESP/wing4.csm

ESP/viewVLM.udc

ESP/viewCFDViscous.udc
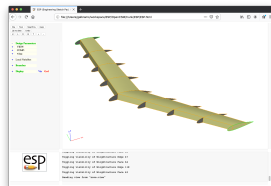
ESP/viewStructure.udc

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`

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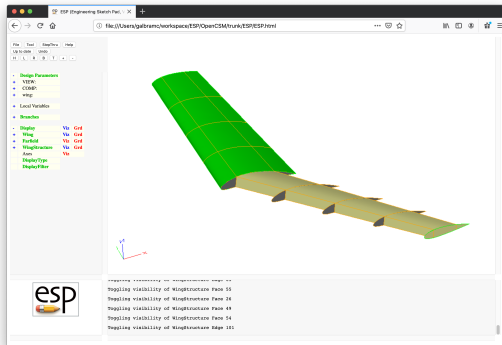
- Training UDC views are flexible, but not universal
    - Designed for ESP/wing*.csm and ESP/transport.csm
- Views are a powerful method for organizing multi-analysis geometry
    - Views should be customized for projects
- More details about the views in ESP training session10

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

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)