

Engineering Sketch Pad (ESP) Training

Session 7: Putting it All Together

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Revised for v1.08





Overview

- Multi-fidelity models
- Using UDCs to build aircraft components
- Assembling an aircraft
- Hand-on exercises
 - myGlider
 - myAircraft
- Course summary



Multi-fidelity Models

- During the design of an aircraft, various coupled models are needed
 - different disciplines
 - structures
 - controls
 - aerodynamics
 - ...
 - different fidelities
 - conceptual design
 - preliminary design
 - detailed design
- There needs to be communication between these models



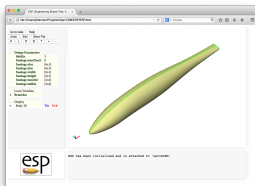
Using UDCs to Build Aircraft Components

- Build a UDC for each major component type
 - wing
 - also used for tail surfaces
 - fuselage
 - duct
 - might use 2 ducts for high-bypass engine
 - pylon
 - connects ducts and wing



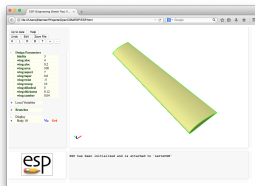
Aircraft UDCs

fidelity = 3



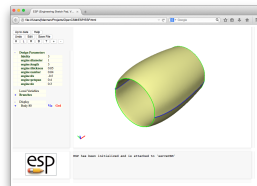
fuselage.udc

xloc (array)
zloc (array)
width (array)
height (array)
noselist (8×1)
taillist (8×1)



wing.udc

aspect
taper
twist
sweep
dihedral
thickness
camber

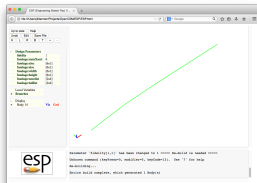


duct.udc

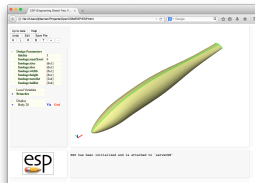
diameter
length
thickness
camber



Transport Fuselage at 2 Fidelities



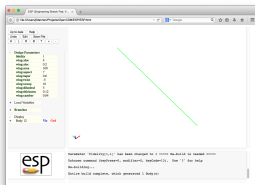
fidelity = 1



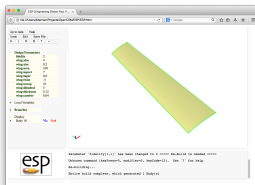
fidelity = 3



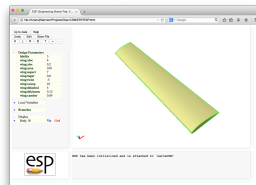
Wing at 3 Fidelities



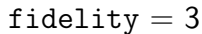
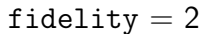
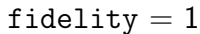
fidelity = 1



fidelity = 2



fidelity = 3





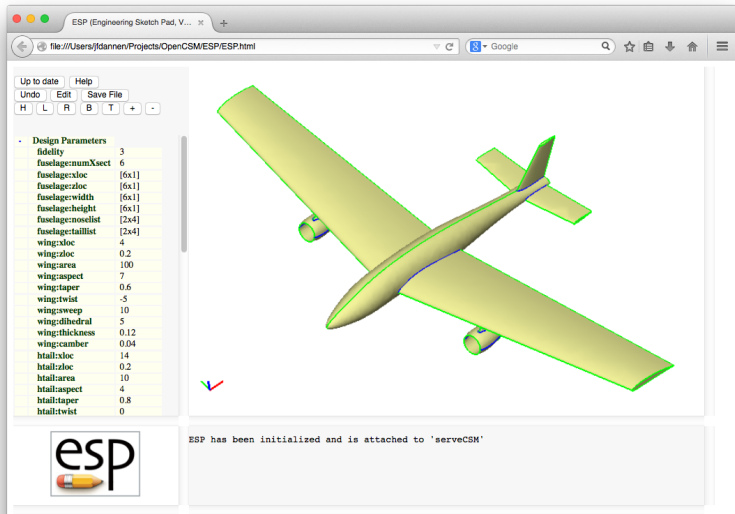
Combine UDCs into Aircraft

- Majors steps:
 - Set up global parameters
 - Set up parameters for, and position of, each component
 - Call each UDC (perhaps multiple times)
 - If not first component
 - combine with previous components



myPlane at fidelity=3

Outer-mold line for CFD





myPlane at fidelity=2

ESP (Engineering Sketch Pad, V...)

file:///Users/jfdannen/Projects/OpenCSM/ESP/ESP.html

Up to date Help
Undo Edit Save File
H L R B T + -

Design Parameters

fidelity	2
fuselage:numXsect	6
fuselage:xloc	[6x1]
fuselage:zloc	[6x1]
fuselage:width	[6x1]
fuselage:height	[6x1]
fuselage:noselist	[2x4]
fuselage:taillist	[2x4]
wing:xloc	4
wing:zloc	0.2
wing:area	100
wing:aspect	7
wing:taper	0.6
wing:twist	-5
wing:sweep	10
wing:dihedral	5
wing:thickness	0.12
wing:camber	0.04
htail:xloc	14
htail:zloc	0.2
htail:area	10
htail:aspect	4
htail:taper	0.8
htail:twist	0

Parameter 'fidelity[1,1]' has been changed to 2 ===== Re-build is needed <=====

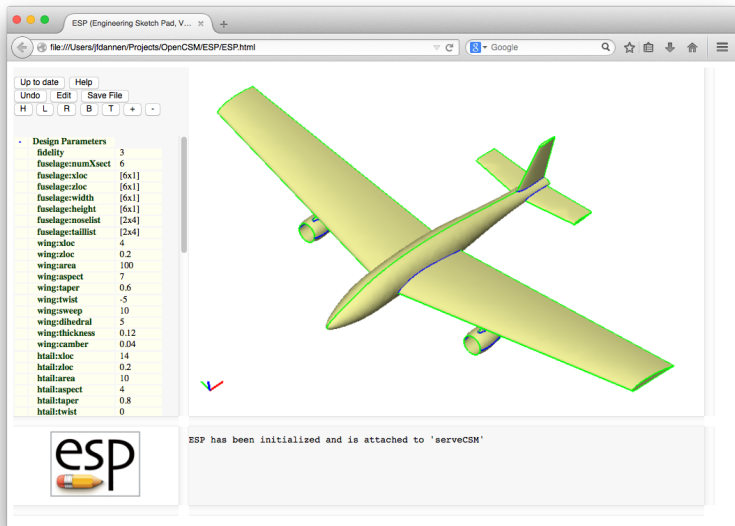
Unknown command (keyPress=0, modifier=0, keyCode=13). Use '?' for help

Re-building...

Entire build complete, which generated 7 Body(s)



myPlane at fidelity=3





Hands-on Exercises

- Run data/CAPS/myPlane
 - vary Design Parameters
 - vary fidelity
- Add a tip-mounted pod
 - use fuselage.udc



Muddy Cards

- Questions / suggestions about multi-disciplinary models
- Questions / suggestions about multi-fidelity modes
- Overall effectiveness of course