

Computational Fluid Dynamics

Presentation Notes

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Introduction

CFD joins theory and experiment

i.e. Low orbit spacecraft cannot be tested in a wind tunnel, extreme speeds & temperatures

Provides lift

$\pm 4^\circ$

SA turbulence

Turbulent behind the wing

Theory

Steady state and turbulent parts, like Math Phys & sounds waves

- Laminar Cylinder
Completely symmetric, cannot tell flow direction
Matches the theory
No boundary layer, fastest at boundary

SU²

Asymmetric, region of low velocity behind cylinder
Boundary layer, zero velocity at boundary

Scripting and Automation

Exports in the form of Tecplot

Shell script to loop through data files

- Turbulent Cylinder
SA turbulence
Vortex is formed, then carried away
1.200s total time
Vortex is shed around 200th iteration, 0.1200s
 $T = 0.067$ s
 $f = 15$ Hz

Results

- Airfoil
Euler simulation
5.0° takeoff
Air moves faster over the wing

Conclusion

Faster computations, and better algorithms