SDAERO™

Small Disturbance Potential Flow Method

Transonic flow calculations in minutes rather than hours - SDAERO couples small disturbance potential flow and integral boundary layer methods to facilitate the rapid design and analysis of wings and bodies in the transonic regime.

Simple input requirements and clearly tabulated output are combined with OMNI3D plotting capability.

SDAERO provides rapid estimation of lift, drag and separation onset throughout the aircraft high-speed flight envelope.

Wing-body optimization for performance and loads is available using the AeroPointer™ software package.

Non-linear aerodynamic loads calculation for multiple flight conditions are made in a fraction of the time required by Euler or Navier-Stokes codes.

Analytical Methods, Inc.
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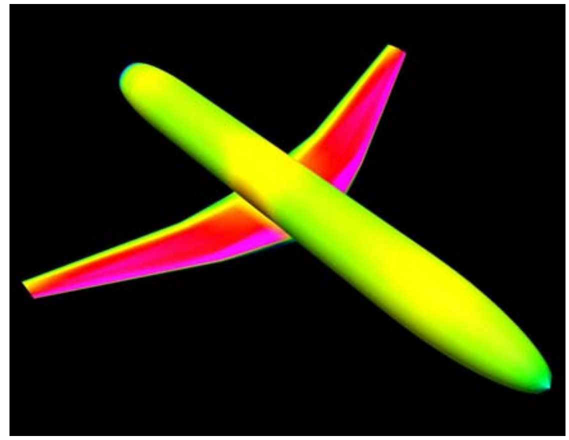
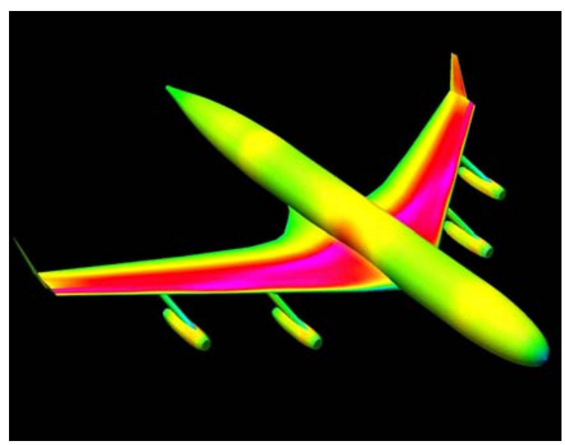
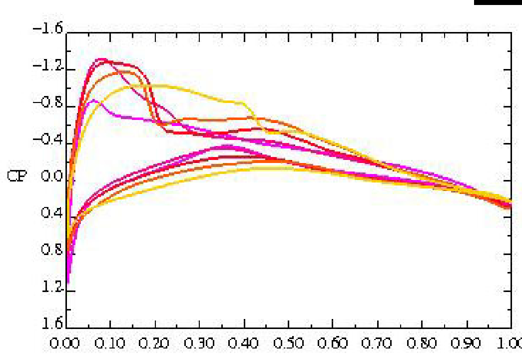
Generic Transport
Optimized for Lift/Drag
using
Aeropointer



Small Business Jet
Wing Design
Performed with
SDAERO

KC-135 Winglet
Modification
Analysis





727 Wing
Pressure
Distributions

SDAERO (Small Disturbance AEROdynamics) provides a fast, accurate method for the computation of transonic flows around wings and bodies. The code, derived from the Grumman-NASA program WIBCO[1], is a finite difference method solving the extended small-disturbance flow equations using an automatically generated, multiple embedded grid system. The user specifies only the surface geometry to be analyzed, the flow conditions and the number of crude/fine grid iterations required for convergence. Viscous effects on the wing are computed by means of an integral boundary layer method. Winglet, engine nacelle, pylon and external store effects are included. The code is ideally suited for transonic wing-body design and analysis when ease of input and fast turnaround are required. It has been widely used in design applications and shows good correlation with wind tunnel data.

Input

Wing, winglet and pylon geometry are input by means of planform and section coordinate data. The capability to import surface geometry from SPIN(g) and PEP are being developed. Complex fuselage shapes can be analyzed using a powerful arbitrary geometry modeling system or by means of cross sectional coordinates. A third option is to input the fuselage, nacelles and stores as bodies of revolution. Engine inlet and exhaust flows are modeled by specifying appropriate mass flow ratios. The user also provides reference flow conditions such as Mach number, angle of attack and Reynolds number.

Output

The output file provides clearly tabulated surface flow data and distributed loads. The surface pressures are integrated to give overall lift, drag and pitching moment coefficients for individual components and the complete configuration. Drag is broken down into friction, wave and lift-induced components. An OMNI3D plot file is generated that displays the three-dimensional geometry and surface flow data. The plot file automatically provides two-dimensional pressure and load distributions and solution convergence history.

Applications

The primary application of SDAERO is wing design for efficient cruise at transonic Mach numbers. Secondary applications include fuselage design, nacelle placement, pylon design, and wing-body interference studies. Run times in the order of a few minutes enable rapid estimation of lift, drag and separation onset throughout the aircraft design envelope for multiple design iterations. The code is also well suited to calculation of the large number of flight conditions required for loads estimation. SDAERO is coupled to the AeroPointer™ code permitting optimization of wing section and planform shapes as well as body area ruling and nacelle placement.

Capabilities

The initial release of SDAERO will perform design, analysis and optimization tasks. Immediately following the initial release, the following features listed below will be added, aimed at increasing the utility of the code in the engineering environment:

- Wing elasticity modeling
- Multiple cases in a single run
- Rotated normal velocities
- Automatic aerodynamic derivative calculation

Planned developments for later release include:

- Addition of tail surfaces
- Asymmetric flows
- Automated loads, stability and control data calculation

Platforms

SDAERO runs on all Windows, Linux and Unix platforms.

Questions?

For more information about SDAERO, please contact:

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[1] "*Transonic Flow Field Analysis for Wing-Fuselage Configurations*", Charles W. Boppe, Grumman Aerospace Corporation, NASA CR 3243.