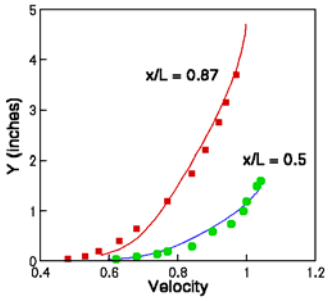
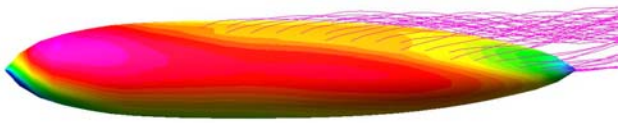
VSAERO™

Nonlinear Aerodynamic Software

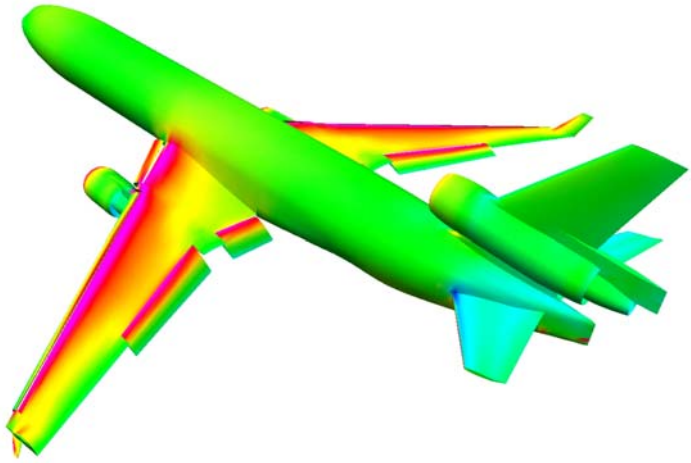
Desktop CFD in minutes - VSAERO couples integral methods for potential and boundary layer flows for low runtimes - a complete Boeing 727 in 300 seconds. Flowfield properties are computed for off-body velocity surveys and on/off -body streamlines. The ability to calculate internal and external flows, non-uniform inflow and body rotation, makes VSAERO applicable to fluid flow problems in aerospace, automotive and marine engineering.

Special purpose modules FSWAVE, ROTOR, and FLIDYN expand VSAERO's simulation capabilities to nonlinear hydrodynamic waves, helicopter rotor/ fuselage interactions, and rigid-body flight dynamics. Zonal coupling to Navier-Stokes codes is available. Running on a wide variety of computers, from Cray Supercomputers to desktop PCs, VSAERO is used worldwide. VSAERO has been used in the development of Rutan Voyager and Beech Starship aircraft, the Stars and Stripes racing yachts and the Sunraycer solar automobile.



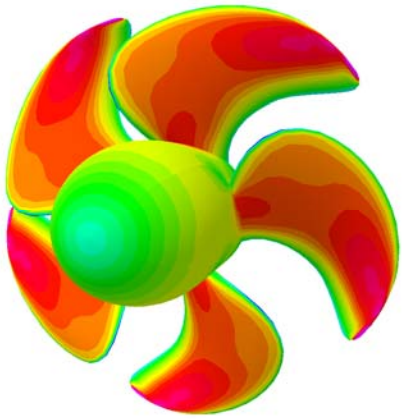


U.S. Airship Akron showing Body Vortex at Angle of Attack and Boundary Layer Velocity Profiles



Panel Model of MD-11 in Ground Effect During Take Off Rotation

Marine Propeller at Advance Ratio of 0.9



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Solver

- VSAERO solves the three-dimensional potential flow equations by the boundary integral method (panel method) based on Morino's formulation
- Viscous boundary layer effects calculated by integral methods which include convergence/ divergence terms along streamlines and are coupled to the potential flow solution by surface transpiration
- Non-zero normal velocities model inlets and exhausts. Rotation rates for aircraft maneuvers and propellers. Non-uniform wind profiles for sailboats and cars
- Wake models for wing trailing-edge separation, bluff-body and cross-flow separation
- Matrix solutions are obtained by a variety of user selected methods (user options for residual convergence provided) which include Direct, Blocked Gauss-Seidel, Banded Jacobi and GMRES solvers
- In-core matrix storage reduces scratch disk space

Oscillate

Oscillate is an option to VSAERO to calculate the aerodynamics of a structure oscillating with a prescribed shape, amplitude and frequency. Oscillate calculates the steady and oscillatory pressures including the in-phase (real) and out-of-phase (imaginary) pressures. Linear analysis is used to achieve calculation times equivalent to steady-state calculations. The unsteady pressures can be linearized about the freestream, or for greater accuracy, linearized from the steady-state solution.

ElasticAIC

An oscillatory option to VSAERO has been developed along with AMIDb, a program to generate an external aerodynamic database for Nastran. Aeroelastic calculations of divergence and flutter are possible. ElasticAIC generates the aerodynamic influence coefficients suitable for calculating pressures on a body undergoing arbitrary oscillation.

Input

- Import of mesh geometry produced by POINTWISE® preprocessor
- SPIN(w) GUI for specifying wakes
- VSAERO supports arbitrary three-dimensional bodies but only requires surface geometry definition and meshing
- Accepts grid point input description of surface geometry in various forms: station, buttline or waterline cuts, non-planar sections and unstructured
- Options for surface biquadratic interpolation of surface mesh through section/point data
- User input of reference flow conditions such as velocity, Mach number, angles of attack and yaw, and Reynolds number

Output

- Surface and wake geometry
- Surface and wake flowfield data
- Total, component, patch, and panel-set forces and moments
- On-body streamline trajectories and flow properties including boundary layer transition, separation, and reattachment predictions
- Off-body flowfield data in volume grids and along streamlines
- Added mass calculations during vehicle acceleration
- Restart file data—complete state of solution at user specified break points
- Plot file data—exports OMNI3D plot file data
- Surface mesh data—exports surface meshes to POINTWISE® preprocessor

Documentation

Complete user's manual describing the underlying theory, input variables (defaults, options, suggested values), and 60 example problems with input and output descriptions.

Questions?

For more information about VSAERO, please contact:

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