

MSES / MISES

Airfoil Synthesis

Whether you need a single airfoil section, multiple sections for a highlift system, or an airfoil for a cascade, this suite of codes allows you to quickly translate your design requirements into an optimum configuration.

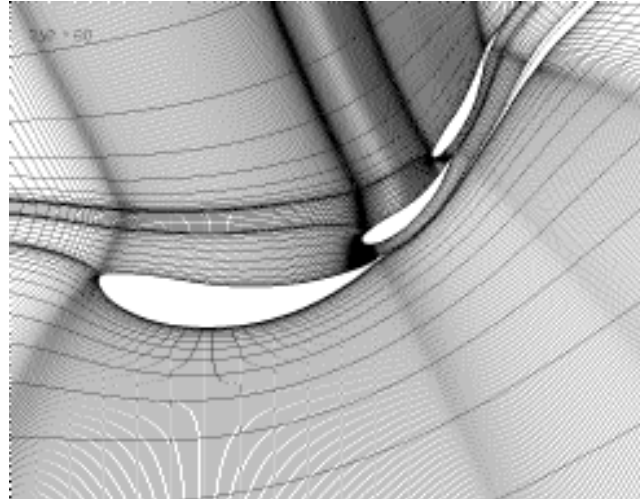
Two-dimensional codes driven with X-Window GUIs allow rapid geometry changes, parametric flow studies, and configuration development: MSES for multi-element airfoils in subsonic and transonic flow; MISES for airfoils in a transonic cascade.

Both codes are developed by Professor Mark Drela at MIT and offer inverse design, forced and natural transition, and direct and inverse interactive boundary layer methods. Grid generation is automatic using a streamline coordinate solution, allowing the grid to adapt to the evolving flow field.

There is no better way to achieve your ideal airfoil design in the least possible time.

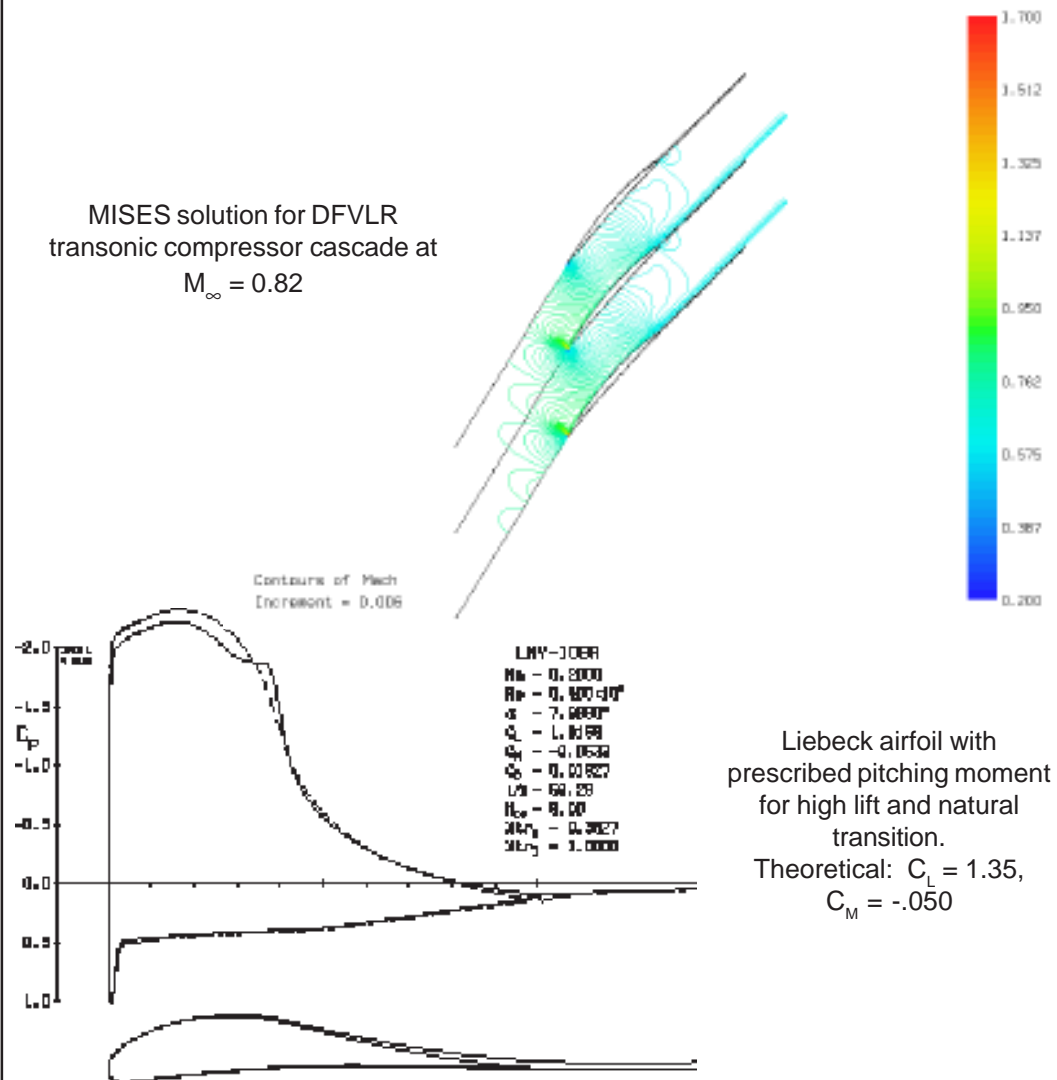


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MSES streamline grid for a 3-element Formula 1 rear wing.

MISES solution for DFVLR transonic compressor cascade at $M_\infty = 0.82$



Liebeck airfoil with prescribed pitching moment for high lift and natural transition.
Theoretical: $C_L = 1.35$,
 $C_M = -0.050$

MSES*

MSES is a coupled viscous/inviscid Euler method for airfoil design and analysis featuring:

Subsonic, Transonic and Supersonic Single- and Multi-Element Airfoil Analysis

- Forced or free boundary layer transition
- Transitional separation bubble modeling
- Lift and drag predictions to just beyond

$$C_{l_{\max}}$$

- Blunt trailing-edge treatment

Computational Design of Multi-Element Airfoil Systems

- Mixed inverse design mode
- Modal inverse design capability
- Modal geometry perturbations

Multi-Point Optimization of Single- and Multi-Element Airfoils With Geometric Thickness and Area Constraints

Polar and Mach Number Sweeps Mode

- Program steps through angles of attack
- Program steps through Mach numbers while holding lift or angle of attack constant

Formulation

A streamline-based Euler discretization and a two-equation boundary layer formulation are coupled through the displacement thickness and solved simultaneously by a full Newton method. Low Reynolds numbers are represented by a full laminar bubble model in boundary layer formulation, or by transition prediction using spatial-amplification theory based on the Orr-Sommerfeld equation. Blunt trailing edges are treated by the incorporation of a short flap, which extends from the trailing edge several base thicknesses downstream, and which is free to move up and down so that it carries no load. The inviscid flow sees the flap thickness plus the total displacement thickness of the upper and lower wake halves, thus producing a smooth displacement body over the trailing edge region.

MISES*

MISES is a version of MSES for stationary and rotating cascades. A modified Abu-Ghannam/Shaw criterion for onset of transition is incorporated, thus including Tolmien-Schlichting and bypass mechanisms.

X-Windows Graphical Interface

- Configuration geometry modification
- Interactive control of gridding
- Presentation of computational results
- Plotting of polars and drag rise curves

Platforms

Both software products are available for all Unix platforms and for Linux.

Questions?

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*Developed by Professor Mark Drela at the Massachusetts Institute of Technology (MIT)