Rotating flow instability prediction using eigenvalue analysis

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I. The nonlinear flow solver

A. Governing equations

B. Spatial discretization

II. Stability analysis

A. Time-domain unsteady approach

B. Eigenvalue approach

III. Eigenvalue analysis for large sparse matrices

IV. Results

A. Laminar flow around a two-dimensional circular cylinder

1. Steady state calculation

2. Unsteady calculation

3. Eigenvalue analysis

B. Transonic buffet around a two-dimensional airfoil (NACA0012)

1. Steady state calculation

2. Unsteady calculation

3. Eigenvalue analysis

C. Rotating stall for an annular compressor cascade (Rotor 67)

1. Steady state calculation

2. Unsteady calculation

3. Eigenvalue analysis

D. Rotating instability for an axial compressor rotor (Rotor 67)

1. Steady state calculation

2. Unsteady calculation

3. Eigenvalue analysis

V. Conclusion

Acknowledgements

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