

NASA Technical Memorandum 102734

**TEMPORAL-ADAPTIVE EULER/NAVIER-STOKES ALGORITHM
FOR UNSTEADY AERODYNAMIC ANALYSIS OF AIRFOILS USING
UNSTRUCTURED DYNAMIC MESHES**

**WILLIAM L. KLEB
JOHN T. BATINA
MARC H. WILLIAMS**

(NASA-TM-102734) TEMPORAL-ADAPTIVE
EULER/NAVIER-STOKES ALGORITHM FOR UNSTEADY
AERODYNAMIC ANALYSIS OF AIRFOILS USING
UNSTRUCTURED DYNAMIC MESHES (NASA) 10 p

N91-10919

Unclass
CSCL 01A 63/02 0711553

NOVEMBER 1990



National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia 23665

- [14] Landon, R. H., "NACA 0012. Oscillating and Transient Pitching," Data set 3 in AGARD-R-702, Compendium of Unsteady Aerodynamic Measurements, August 1982.
- [15] Mavriplis, D. J., "Adaptive Mesh Generation for Viscous Flows Using Delaunay Triangulation," ICASE Report No. 88-47, August 1988.

1. Report No. NASA TM-102734		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Temporal-Adaptive Euler/Navier-Stokes Algorithm for Unsteady Aerodynamic Analysis of Airfoils Using Unstructured Dynamic Meshes				5. Report Date November 1990	
				6. Performing Organization Code	
7. Author(s) William L. Kleb John T. Batina Marc H. Williams				8. Performing Organization Report No.	
				10. Work Unit No. 505-63-50-12	
9. Performing Organization Name and Address NASA Langley Research Center Hampton, Virginia 23665-5225				11. Contract or Grant No.	
				13. Type of Report and Period Covered Technical Memorandum	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546-0001				14. Sponsoring Agency Code	
15. Supplementary Notes Presented as AIAA Paper No. 90-1650 at the AIAA 21st Fluid Dynamics, Plasma Dynamics, and Lasers Conference, Seattle, Washington, June 18-20, 1990. William L. Kleb and Marc H. Williams: Purdue University, West Lafayette, Indiana. John T. Batina: Langley Research Center, Hampton, Virginia.					
16. Abstract A temporal adaptive algorithm for the time-integration of the two-dimensional Euler or Navier-Stokes equations is presented. The flow solver involves an upwind flux-split spatial discretization for the convective terms and central differencing for the shear-stress and heat flux terms on an unstructured mesh of triangles. The temporal adaptive algorithm is a time-accurate integration procedure which allows flows with high spatial and temporal gradients to be computed efficiently by advancing each grid cell near its maximum allowable time step. Results indicate that an appreciable computational savings can be achieved for both inviscid and viscous unsteady airfoil problems using unstructured meshes without degrading spatial or temporal accuracy.					
17. Key Words (Suggested by Author(s)) Unsteady Aerodynamics Computational Fluid Dynamics Transonic Flow				18. Distribution Statement Unclassified - Unlimited Subject Category 02	
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of pages 9	
				22. Price A02	