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AEROELASTIC, CFD, AND DYNAMICS COMPUTATION AND OPTIMIZATION FOR BUFFET AND FLUTTER APPLICATIONS

Principal Investigator: Osama A. Kandil

Final Report
For the period December 1, 1995 through November 30, 1996

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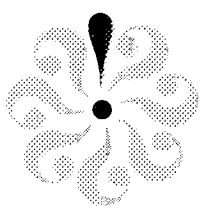

AEROELASTIC, CFD AND DYNAMICS COMPUTATION AND OPTIMIZATION FOR BUFFET AND FLUTTER APPLICATIONS
GRANT NO. NAG-1-648

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Accomplishments

In the period of December 1, 1995 to November 30, 1996, the Principal Investigator (PI) along with the assistance of three Ph.D. students have achieved the following accomplishments under this grant:

I. Publications

I.1. Kandil, O. A., Massey, S. J. and Sheta, E. F., "Structural Dynamics-CFD Interaction for Computations of Vertical Tail Buffet," Royal Aeronautical Journal, U.K., August/September, 1996; pp. 297-303. (a copy is attached).

I.2. Kandil, O. A., "Recent Advances in Multidisciplinary Aeronautical Problems of Fluid/Structures/Dynamics Interaction," International Seminar Series II Proceedings, Institute of Aeronautics and Applied Mechanics, Warsaw University of Technology, November 1996. Invited paper.

I.3. Kandil, O. A., Massey, S. J. and Sheta, E. F., "Aerostructural Vortical Flow Interactions with Application to F/A-18 Tail Buffet," High-Angle-of-Attack Technology Conference, NASA Langley, September 17–19, 1996. (A copy is attached).

I.4. Menzies, M. A. and Kandil, O. A., "Natural Rolling Responses of a Delta Wing in Transonic and Subsonic Flows," AIAA 96–3391–CP, AIAA Atmospheric Flight Mechanics Conference, San Diego, CA, July 29–31, 1996, pp. 246–254. (a copy is attached).

I.5. Kandil, O. A. and Menzies, M. A., "Effects of Coupled Rolling and Pitching Oscillations on Transonic Shock-Induced Vortex-Breakdown Flow of a Delta Wing," Sixth International Symposium on Computational Fluid Dynamics (ISCFD), Lake Tahoe, NV, September 4–8, 1995, Invited Paper, Vol. II, pp. 564–569.

I.6. Kandil, O. A. and Menzies, M. A., "Effective Control of Computationally simulated Wing Rock in Subsonic Flow," AIAA 97–0831, AIAA 35th ASM, Reno, Nevada, January 1997.

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* Professor and Eminent Scholar

I.7. Kandil, O. A. and Menzies, M. A., "Coupled Rolling and Pitching Oscillation Effects on Transonic Shock-Induced Vortex-Breakdown Flow of a Delta Wing," AIAA-96–0828, AIAA 34th ASM, Reno, Nevada, January 13–18, 1996. (A copy is attached).

II. Abstracts Submitted to Technical Conferences

II.1. Kandil, O. A., and Abdelhamid, Y., "Computation and Validation of Delta-Wing Flow Response Due to 0°–90° Pitching Motion," AIAA Atmospheric Flight Mechanics Conference, New Orleans, LA, August 11–13, 1997.

III. Animation Movies Produced

III.1. "Aerostructural Vortical Flow Interactions with Application to F/A-18 Tail Buffet," Kandil, O. A., Massey, S. J. and Sheta, E. F., September, 1996.

This simulation movie was first shown at the High-Angle-of-Attack Technology Conference, NASA Langley, September 17–19, 1996. The Virginia State Fair has also requested the permission to show the movie at the VA State Fair on Aerospace Industry, September 30, 1996. The movie has also been shown at The International Seminar Series of The Institute of Aeronautics and Applied Mechanics, Warsaw University of Technology, Warsaw, Poland, November 26, 1996.

The movie exists on the NAS simulation files and the ODU/Aero Web page to be accessed and viewed.

III.2. "Natural Rolling Response of a Delta Wing in Transonic Flow," Kandil, O. A. and Menzies, M. A., July 1996.

The movie has been shown at the AIAA Atmospheric Flight Mechanics Conference, San Diego, CA, July 29–31, 1996. It was also shown in Warsaw, Poland (same conference listed above), November 26, 1996.

IV. Proposal Submitted For CRAY C-90 Usage

A proposal has been submitted and approved for usage of the National Aerodynamic Simulation Facilities at NASA Ames Research Center, CA, September 1996. The proposal has been funded for 150 hrs. of C-90 CPU time.

A technical summary has also been submitted along with the F/A-18 simulation movie to NAS in December, 1996.

V. Graduate Students

Three Ph.D. students have been assisting the P.I. to carry out the tasks of this research grant and write their Ph.D. Dissertations. Two of these students are supported by the Aerospace Engineering Department and one is supported under this grant. One of the students (Ms. Margaret A. Menzies) wrote her Ph.D. Dissertation and successfully defended it in May 1996. She is currently employed by The Aviation Specialists Company in Charolettsville, VA. Her Ph.D. Dissertation is titled "Unsteady, Transonic Flow Around Delta Wings Undergoing Coupled and Natural Modes Response–A Multidisciplinary Problem." The cover page and a summary are attached. The status of the other two students is given below:

V1. Mr. Steven J. Massey (U.S. Citizen): He has been working on his Ph.D. degree since May 1994. He has been supported under this grant and a fellowship from the AE Dept. Currently, he is a Ph.D. candidate (since Spring 1996). He is expected to finish his Ph.D. degree in August 1997. His Ph.D. dissertation focuses on single and twin tail buffet prediction and control.

V2. Mr. Mark W. Flanagan (U.S. Citizen): He has been working on his Ph.D. degree since January 1994. He has been supported under a fellowship from the AE Dept. and work at Dynamic Engineering Inc. currently, he is a Ph.D. candidate (since Spring 1996) and he is expected to finish his Ph.D. degree in December 1997. His Ph.D. dissertation focuses on simulation and optimization control of tail buffet in supersonic internal vortex breakdown flows in a configured duct.

VI. Conference and Technical Meetings Presentations and Activities

1. "Recent Advances in Multidisciplinary Aeronautical Problems of Fluids/Structures/Dynamics Interaction," Institute of Aeronautics and Applied Mechanics, Warsaw university of Technology, Warsaw, Poland, November 27–30, 1996 (Invited). Prof. Kandil gave the presentation.

2. "Aerostructural Vortical Flow Interactions with Applications to F/A-18 and F-117 Tail Buffet," High-Angle-of-Attack Technology Conference, NASA Langley Research Center, Hampton, VA, September 17–19, 1996. Prof. Kandil gave the presentation.

3. "Natural Rolling Responses of a Delta Wing in Transonic and Subsonic flows," AIAA Atmospheric Flight Mechanics Conference, San Diego, CA, July 27–31, 1996. Prof. Kandil gave the presentation.

4. "Recent Advances in Fluid/Structure/Dynamics Interaction with Aerospace Applications," International Conference on Nonlinear Problems in Aerospace Engineering, Daytona Beach, FL, May 9–12, 1996 (Invited). Prof. Kandil gave the presentation.

5. "Coupled Rolling and Pitching Oscillation Effects on Transonic Shock-Induced Vortex-Breakdown flow of a Delta Wing," AIAA 33rd ASM, Reno, Nevada, January 15–19, 1996. Dr. Menzies gave the presentation.

6. "Effects of Coupled Rolling and Pitching Oscillations on Transonic Shock-Induced Vortex-Breakdown Flow of a Delta Wing," 6th International Symposium on computational Fluid Dynamics, Lake Tahoe, NV, September 4–6, 1995, Invited paper. Prof. Kandil gave the presentation.