7 July 2017

Robert S. Webster, Ph.D.

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Education

Ph.D., Aerospace Engineering, Mississippi State University, May, 2001
M.S., Aerospace Engineering, Mississippi State University, August, 1994
Bachelor of Aerospace Engineering, Auburn University, December, 1986

Employment

Associate Professor, Department of Mechanical Engineering, University of Tennessee at Chattanooga, January, 2017 to Present
Associate Research Professor, Department of Computational Engineering, University of Tennessee at Chattanooga, July, 2008 to December, 2016
Assistant Research Professor, Department of Computational Engineering, University of Tennessee at Chattanooga, December, 2002 to July, 2008
Postdoctoral Fellow, Engineering Research Center, Mississippi State University, May, 2001 to December, 2002
Graduate Research Assistant (PhD Program), Engineering Research Center, Mississippi State University, August, 1994 to May, 2001
Graduate Research Assistant (MS Program), Engineering Research Center, Mississippi State University, January, 1992 to August, 1994
Aerospace Technologist, NASA Marshall Space Flight Center (MSFC), January, 1989 to December, 1991
Mechanical Engineer, US Army TMDE Support Group, Redstone Arsenal, AL, January, 1987 to December, 1988

Research Interests

Dr. Webster has been involved in various areas of aerospace propulsion since the beginning of 1989. For three years, Dr. Webster gained experience as an engineer with NASA by serving as an engine system analyst for the Liquid Propulsion Systems Branch at MSFC. This work involved the use of a steady-state power-balance model for liquid-propellant engine system analysis. It also provided an appreciation and understanding that practically everything must function to some degree as part of a system. Since that time, Dr. Webster has been involved in various aspects of aerospace propulsion applications through the use of computational fluid dynamics. This computational experience consists of simulating flow fields of, for example, helicopter rotors, high-speed internal and external flows related to launch vehicles, turbomachinery flow fields, and both ideal-gas and equilibrium-chemistry nozzle flows. In short, Dr. Webster's underlying interest is in the physics of aero-thermal flow fields, with an experience base in unsteady viscous flows and computational applications in aerodynamics, propulsion and turbomachinery. As the general area of aerospace propulsion is a combination of fluid mechanics, thermodynamics, and heat transfer, this field of research serves as a means for naturally satisfying Dr. Webster's professional interests.

University Service

Major Professor for 1 Master Degree and 1 Doctoral Degree Candidates
Committee Member for 5 Master Degree and 2 Doctoral Degree Candidates

Courses Taught

ENGR-1030, Basic Engineering Science; calculus-based Newtonian mechanics
ENCM-7340, Viscous Flow Computation; computation of viscous flow fields, introduction to turbulent flows and turbulence modeling
ENCH-3320, Heat Transfer Processes; introduction to heat transfer in solids and fluids

Seminar Presentations

Webster, R. S. and Sreenivas, K., "An Overview of Rotating Machinery Simulations and Applications," presented to the faculty and students of The University of Tennessee Space Institute, 23 March, 2016.

Professional Affiliations and Honors

AIAA Inlets, Nozzles, and Propulsion Systems Integration Technical Committee; elected 2017
AIAA Gas Turbine Engine Technical Committee; 2008 – 2015; Member (presently Emeritus Member)
American Society of Mechanical Engineers (ASME); 2001 – Present; Member
American Institute of Aeronautics and Astronautics (AIAA); 1995 – Present; Senior Member
Sigma Gamma Tau (Aerospace Engineering Honor Society); Auburn University, 1986

Awards

AIAA Best Paper in Air Breathing Propulsion, 2005/2006; awarded by AIAA Air Breathing Propulsion Technical Committee for *AIAA-2006-0418* (co-author) entitled "Numerical Simulation of Stall and Stall Control in Axial and Radial Compressors"; awarded at 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference Awards Luncheon, 12 July, 2006.

Reviewer

ASME TURBO EXPO: 2004 – 2005, 2009 – 2017
AIAA Journal: 2010, 2013, 2017
AIAA Aerospace Sciences Meeting: 2010, 2015
International Journal for Computational Methods in Engineering Science & Mechanics: 2010
U.S. Army Research Office Grant Review: 2011
Aerospace Science and Technology: 2012
AIAA Joint Propulsion Conference: 2013 – 2017
AIAA Journal of Propulsion and Power: 2014 – 2015
AIAA Journal of Aircraft: 2015
Engineering Science and Technology, an International Journal: 2015
ASCE Journal of Aerospace Engineering: 2016-2017

Thesis:

Webster, R. S., "Numerical Solution of a Helicopter Rotor in Hover and Forward Flight," Mississippi State University, August, 1994. An isolated, two-bladed rotor was simulated using an early version of the TURBO flow solver. Hover simulations were compared to experimental values of Cp at various span locations for subsonic and transonic tip Mach numbers. The code was modified to input cyclic pitching parameters, such that the blade pitch angle and the near-field grid could be adjusted as a function of rotor azimuth angle. A hypothetical forward-flight case was simulated as proof of concept.

Dissertation:

Webster, R. S., "A Numerical Study of the Conjugate Conduction-Convection Heat Transfer Problem," Mississippi State University, May, 2001. An existing in-house equilibrium-chemistry, compressible flow solver was modified to enable the thermal coupling of the external/internal flow field and solid bodies adjacent to or within the flow field in a transient manner. Comparisons were made with theoretical conduction-only problems, as well as "canonical" convection problems. Simulation results were also compared to two experiments in which heat flux and/or temperature were compared to transient measurements with good agreement.

Computer Skills/Experience:

Experience with the use of Windows/Office tools, as well as Unix/Linux operating system
Experience with the use of C-based scripting
Primary coding experience is with FORTRAN
Experience with the use of FieldView and TecPlot

Publications

1. Sreenivas, K., Webster, R. S., and Hereth, E. A., "Single and Dual Flow Nozzle Simulations using Tenasi," *AIAA-2017-4656*, 53rd AIAA/SAE/ASEE Joint Propulsion Conference, July, 2017.
2. Sreenivas, K., Webster, R. S., and Hereth, E. A., "Impact of High-Order Spatial Accuracy on Multi-Stage Turbomachinery Simulations," *AIAA-2017-4823*, 53rd AIAA/SAE/ASEE Joint Propulsion Conference, July, 2017.
3. Collao, M. D., Webster, R. S., Sreenivas, K., "Testing Protruding Studs as a Form of Casing Treatment on a Transonic Turbofan: A Computational Study," *GT2017-65257*, ASME TURBO EXPO 2017, June, 2017.
4. Collao, M. D., Webster, R. S., Sreenivas, K., and Lin, W., "Computational Study of the Effects of Protruding Studs Casing Treatment on the Performance of an Axial Transonic Turbofan," *AIAA-2016-4646*, 52nd AIAA/SAE/ASEE Joint Propulsion Conference, July, 2016.
5. Sreenivas, K, Webster, R. S., Hereth, E. A., Berdanier, R. A., and Key, N. L., "Computational Simulations of a Multi-stage Subsonic Research Compressor," *AIAA-2016-0395*, 54th AIAA Aerospace Sciences Meeting, January, 2016.
6. Kamali, S., Ahrabi, B. R., Webster, R. S., and Sreenivas, K., "Numerical Simulation of Compressible Flow in a Diffusing S-duct with and without Vortex Generators," *AIAA-2015-2715*, 33rd AIAA Applied Aerodynamics Conference, June, 2015.
7. Webster, R. S., Sreenivas, K., and Hilbert, C. B., "Computational Simulation of the Fan and Low-pressure Compressor Stages of the Energy Efficient Engine," *AIAA-2015-1344*, 53rd AIAA Aerospace Sciences Meeting, January, 2015.
8. Taylor, L.K., Sreenivas, K., Webster, R.S., and Kress, J., "An Artificial Compressibility Algorithm for Convective Heat Transfer," *AIAA-2013-2894*, 44th AIAA Thermophysics Conference, June 2013.
9. Ahrabi, B.R., Sreenivas. K., and Webster, R.S., "Computational Investigation of Compressible Flow in a Diffusing S-duct," *AIAA-2013-3601*, 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July 2013.
10. Flynt, G.A., Webster, R.S., and Sreenivas. K., "Computation of Heat Transfer In Turbine Rotor Blade Cooling Channels with Angled Rib Turbulators," *AIAA-2013-3621*, 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July, 2013.
11. Lin, W., Sreenivas, K., Webster, R.S., and Hyams, D.G., "Effect of Casing Groove Locations on the Performance of an Axial Flow Stage," *AIAA-2013-3632*, 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July, 2013.
12. Webster, R. S., Sreenivas, K., Hyams, D. G., Hilbert, C. B., Briley, W. R., and Whitfield, D. L., "Demonstration of Sub-system Level Simulations: A Coupled Inlet and Turbofan Stage," *AIAA-2012-4282*, 48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, August, 2012.

13. Lin, W., Sreenivas, K, Webster, R. S., and Hyams, D. G., "Effect of Casing and Tip Modifications on the Performance of an Axial Flow Stage," *AIAA-2012-0475*, 50th AIAA Aerospace Sciences Meeting, January, 2012.
14. Hyams, D. G., Webster, R. S., Currier, N., and Sreenivas, K., "A Generalized, Interpolative Interface Method for Rotor-Stator Interactions," *AIAA-2011-3700*, 20th AIAA Computational Fluid Dynamics Conference, June, 2011.
15. Hyams, D. G., Webster, R. S., and Sreenivas, K., "A Generalized, Interpolative Interface for Parallel Unstructured Flow Solvers," *AIAA-2010-5097*, 40th AIAA Fluid Dynamics Conference, June, 2010.
16. Webster, R. S., Sreenivas, K., and Hyams, D. G., "Unstructured Grid Technology Applied to Axial-flow Compressors," *AIAA-2010-1605*, 48th AIAA Aerospace Sciences Meeting, January, 2010.
17. Johnson, B. C., Webster, R. S., and Sreenivas, K., "A Numerical Investigation of S-Duct Flows with Boundary Layer Ingestion," *AIAA-2010-0841*, 48th AIAA Aerospace Sciences Meeting, January, 2010.
18. Arabshahi, A., Webster, R. S., Sreenivas, K., Hyams, D. G., and Whitfield, D. L., "Numerical Simulation of Reacting and Non-reacting Nozzle Flows," *AIAA-2009-4858*, 45th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, August, 2009.
19. Chen, J-P, Johnson, B., Hathaway, M. D., and Webster, R. S., "Flow Characteristics of Tip-Injection on Compressor Rotating Instability via Time-Accurate Simulation", *AIAA Journal of Propulsion and Power*, Vol. 25, No. 3, May-June, 2009, pp. 678-687.
20. Arabshahi, A., Webster, R. S., Briley, W. R., and Whitfield, D. L., "Numerical Analysis of Solid Propellant Rocket Motor Internal Flows," *AIAA-2006-5114*, 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July, 2006.
21. Chen, J-P, Webster, R. S., Hathaway, M. D., Herrick, G. P., and Skoch, G. J., "Numerical Simulation of Stall and Stall Control in Axial and Radial Compressors," *AIAA-2006-0418*, 44th AIAA Aerospace Sciences Meeting, January, 2006.
22. Webster, R. S., "Numerical Study of Base Flow Induced by Exhaust Plume impingement," *AIAA-98-3621*, 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July, 1998.
23. Webster, R. S., Chen, J-P, and Whitfield, D. L., "Numerical Solution of a Helicopter Rotor in Hover and Forward Flight," *AIAA-95-0193*, 33rd AIAA Aerospace Sciences Meeting, January, 1995.

Sponsored-Research Reports

1. Webster, R. S., Sreenivas, K., Hyams, D.G., Burdyshaw, C., Taylor, L.K., Briley, W.R., and Whitfield, D.L., "Validated Aerodynamic Analysis and Design Tools for Integrated Embedded Aircraft Propulsion Systems," Final Progress Report, 28 February, 2011.
2. Webster, R. S., Sreenivas, K., Hyams, D.G., Burdyshaw, C., Taylor, L.K., Briley, W.R., and Whitfield, D.L., "Validated Aerodynamic Analysis and Design Tools for Integrated Embedded Aircraft Propulsion Systems," 2nd Annual Interim Progress Report, 9 June, 2009.
3. Sreenivas, K., Webster, R.S., Hyams, D.G., Burdyshaw, C., Taylor, L.K., Briley, W.R., and Whitfield, D.L., "Validated Aerodynamic Analysis and Design Tools for Integrated Embedded Aircraft Propulsion Systems," 1st Annual Interim Progress Report, 2 July, 2008.
4. Webster, R. S., et al., "Computational Analysis Assessment and Advancement of Liquid Rocket Engine Turbo-pump Modeling and Simulation Tools," Final Report, December, 2005.
5. Webster, R. S., "Numerical Validation of Stall Control Technology for the CC3 High-Speed Centrifugal Compressor," Final Report, September, 2005.
6. Hathaway, M.D., Chen, J.P., Webster, R.S., and Herrick, G.P., "Time Accurate Simulation of the Stall Inception Process in the Compression System of a US Army Helicopter Gas Turbine Engine", Final Year Progress, presented at DoD HPCMP User's Group Conference, June 2005.
7. Webster, R. S., Mitchell, B. J., Taylor, L. K., and Whitfield, D. L., "Bio-Inspired Delayed Stall Fan/Compressor for Increased Performance," Final Report, December, 2004.
8. Hathaway, M.D., Chen, J.P., Webster, R.S., and Herrick, G.P., "Time Accurate Simulation of the Stall Inception Process in the Compression System of a US Army Helicopter Gas Turbine Engine",

Second Year Progress, presented at DoD HPCMP User's Group Conference, June 2004.

9. Webster, R. S., Mitchell, B. J., and Taylor, L. K., "3-D Navier-Stokes Analysis for a Compressor Stage," Final Report, June, 2004.
10. Hathaway, M.D., Chen, J.P., and Webster, R.S., "Time Accurate Unsteady Simulation of the Stall Inception Process in the Compression System of a US Army Helicopter Gas Turbine Engine", First Year Progress, presented at DoD HPCMP User's Group Conference, June 2003.
11. Webster, R. S., "A Numerical Study of the Conjugate Conduction-Convection Heat Transfer Problem," Ph.D., Dissertation, Mississippi State, MS, May, 2001.
12. Webster, R. S., "Numerical Solution of a Helicopter Rotor in Hover and Forward Flight," M. S. Thesis, Mississippi State, M.S., August, 1994.

Participation in Grants/Contracts

1. Principal Investigator for "Numerical Simulations of Axial Compressor Flow Fields Employing Higher-order Accuracy," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2016 – 30 June, 2017; $24, 140.
2. Principal Investigator for "Computational Simulation of the Purdue 3-stage Experimental Core Compressor," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2015 – 30 June, 2016; $80,591.
3. Principal Investigator for "Computational Simulation of a Blow-down Tunnel for Turbine Testing at Purdue," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2015 – 30 June, 2016; $80,591.
4. Principal Investigator for "Large-scale Simulation of Low-pressure Compression System of the Energy Efficient Engine," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2014 – 30 June, 2015; $14,000.
5. Principal Investigator for "Validation Simulations of the Turbofan and Boost Stages of the Energy Efficient Engine," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2013 – 30 June, 2014; $10,000.
6. Principal Investigator for "Aero-elastic Study of the Turbofan Stage of the Energy Efficient Engine," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2013 – 30 June, 2014; $50,000.
7. Co-Investigator for "An Exploration of the Efficacy of HUGG Style Meshes on Turbo-machinery," funded by Tennessee Higher Education Commission Center of Excellence in Applied Computational Science and Engineering; 01 July, 2013 – 30 June, 2014; $25,000.
8. Co-Investigator for "Validated Aerodynamic Analysis and Design Tools for Integrated Embedded Aircraft Propulsion Systems," funded by NASA Glenn Research Center; August, 2007 – August, 2010; $1,527,000.
9. Co-Investigator for "Computational Analysis Assessment and Advancement of Solid Rocket Motor (SRM) Modeling and Simulation Tools," funded by U. S. Air Force Research Lab. (through subcontract to SPARTA, Inc.); 31 January, 2005 – 14 July, 2006; $150,000.
10. Co-Investigator for "Computational Analysis Assessment and Advancement of Liquid Rocket Engine Turbo-pump Modeling and Simulation Tools," funded by U. S. Air Force Research Lab. (through subcontract to Barber-Nichols, Inc.); 1 January, 2005 – 30 September, 2005; $178,000.
11. Principal Investigator for "Numerical Validation of Stall Control Technology for the CC3 High-Speed Centrifugal Compressor," funded by U. S. Army Research Lab. (through subcontract to Mississippi State University); 01 April, 2005 – 31 August, 2005; $20,000.
12. Co-Investigator for "Bio-Inspired Delayed Stall Fan/Compressor for Increased Performance," funded by Continuum Dynamics, Inc.; 16 June, 2004 – 13 October, 2004; $20,000.
13. Co-Investigator for "3-D Navier-Stokes Analysis for a Compressor Stage," funded by Barber-Nichols, Inc.; 01 May, 2004 – 30 June, 2004; $12,000.