Paul G. A. Cizmas

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LEGAL: US citizen

EDUCATION:

1995 Duke University1984 Bucharest Polytechnic Institute

Ph.D., Mechanical Engineering Dipl.Ing., Aerospace Engineering

SUMMARY OF RESEARCH AND EDUCATIONAL ACTIVITIES

Paul Cizmas is actively conducting research in propulsion, aeroelasticity, and computational fluid dynamics. Upon receiving his Ph.D. degree, Paul worked for three years at the Westinghouse Science & Technology Center in Pittsburgh, PA. While at Westinghouse, Paul was responsible for the development of computational fluid dynamic analyses for turbomachinery. His work concentrated on unsteady flows in turbomachinery using both time-linearization and time-marching methods. Paul pioneered the use of the time-linearization method for prediction of stall flutter in turbomachinery. For this contribution he received the ASME Liquid Propulsion 1995 Best Paper Award. Paul was among the first to use parallel processing for numerical simulation of unsteady flows in turbomachinery. For this contribution he received the Westinghouse Science and Technology 1997 Technical Publication Award. For his work on the prediction of aeroacoustic resonance in cavities of hole-pattern stator seals, Paul received the ASME Structures & Dynamics Committee Best Paper Award in 2011.

Since he joined Texas A&M University, Paul has been investigator for 44 research contracts, on 39 of which he was the principal investigator. Currently Paul has four active research contracts. His research has been supported by various government agencies and industrial companies including the Department of Energy, the National Academy of Sciences, Air Force Office of Scientific Research, Vestas Wind Energies S/A, the Tennessee Valley Authority, the Air Force Research Laboratory, Siemens Westinghouse Power Corporation, Northrop Grumman, Ball Aerospace & Technology Corporation, Siemens, the Turbomachinery Research Consortium, Westinghouse Electric Company and the Texas Higher Education Coordinating Board.

Paul developed the PaRSI code for analysis of rotor-stator interaction and unsteady flow effects in multi-stage compressors and turbines, the CoRSI code for simulation of *in situ* reheat in turbines and analysis of turbine-combustors, the UNS3D general computational fluid dynamics code, and the AE code for high-fidelity aeroelastic analysis. He recently developed a system that reduces thermal signature of a jet engine in order to decrease the vulnerability of military and civilian airplanes to heat-seeking missiles.

Paul extended the reduced-order model based on the proper orthogonal decomposition (POD) method to deforming structures by developing a dynamic POD model. This model has been implemented in a CFD code for modeling the aeroelastic response of turbomachinery compressors and turbines. This method allows a reduction of the computational time of aeroelastic phenomena by at least one order of magnitude, while providing a high-accuracy solution. This software has been recently licensed to jet engine and gas turbine manufacturers such as General Electric, Pratt & Whitney, Honeywell, Rolls-Royce and Mitsubishi.

Paul reintroduced the Unsteady Aerodynamics AERO 620 and the Aerospace Propulsion AERO 417 courses. He updated the Numerical Methods for Internal Flows AERO 615 and the Aerothermodynamics and Propulsion AERO 351 courses. Paul introduced a computational fluid dynamics class for the undergraduate students (currently AERO489).

He is an Associate Fellow of AIAA. Paul received the Texas Engineering Experiment Station (TEES) Select Young Faculty award in 2004, the Brockett Professorship Award in 2008 and the Herbert H. Richardson Award in 2009.

Paul was appointed to the National Research Council Committee on Air Force/Department of Defense Aerospace Propulsion (2005) that was chartered by the Director of Defense Research and Engineering to provide input on the needs of the Department of Defense propulsion for the next 15 to 20 years.

TEACHING EXPERIENCE:

9/2009-present	Texas A&M University, Department of Aerospace Engi-	Professor
9/2004-8/2009	neering Texas A&M University, Department of Aerospace Engi-	Associate Professor
8/1998-8/2004	neering Texas A&M University, Department of Aerospace Engi- neering	Assistant Professor
9/1988-9/1991	Bucharest Polytechnic Institute, Department of Aero- space Engineering	Assistant Professor

RESEARCH EXPERIENCE:

10/1995-7/1998	Westinghouse Electric Corporation, Science and Tech-	Senior Engineer/-
	nology Center	Scientist
5/1995- $7/1995$	Duke University, Department of Mechanical Engineering	Research Associate
	and Materials Science	
9/1991- $5/1995$	Duke University, Department of Mechanical Engineering	Research Assistant
	and Materials Science	
9/1986-9/1988	Bucharest Polytechnic Institute, Department of Strength	Research Engineer
	of Materials and Department of Road Motor Vehicles	
9/1984- $9/1986$	Turbomecanica Jet Engine Company and National In-	Design Engineer
	stitute for Heat Engines, Bucharest, Romania	

AWARDS AND HONORS:

Dates	Society or Organization	Name of Award/Recognition
2016	ASME	ASME Fellow
2011	ASME	ASME Structures and Dynamics Committee 2010 Best Paper
		Award
2009	Texas A&M University	Herbert H. Richardson Faculty Fellow Award
2008	Texas A&M University	E. D. Brockett Professorship Award
2005	National Research	Appointed to the National Research Council Committee on
	Council	Air Force/Department of Defense Aerospace Propulsion
2005	ASME	Certificate of Appreciation from the ASME International Gas
		Turbine Institute
2004	Texas A&M University	Texas Engineering Experiment Station Select Young Faculty
2003	National Research	National Research Council/Air Force Office of Scientific Re-
	Council	search Summer Faculty Fellowship, Wright-Patterson AFB
2002	AIAA	Associate Fellow AIAA
2000	Air Force Research La-	Summer Faculty Fellow
	boratory	
1997	Westinghouse	Westinghouse Science and Technology 1997 Technical Publi-
		cation Award
1996	ASME	ASME Liquid Propulsion 1995 Best Paper Award
1991	Duke University	Graduate Fellowship
1984	Bucharest Polytechnic	Aerospace Engineering Department Valedictorian, Dipl. Ing.
	Institute	- Graduated first out of 163 students
1983	Romanian Ministry of	Romanian National Scholarship, the most prestigious gradu-
	Education	ate studies scholarship

RESEARCH

PUBLICATIONS

BOOKS:

Cizmas, P., Constantinescu, I. N. and Ionescu, B., *Finite Element Method*, I.P.B. Press, Bucharest, Romania, 1991.

BOOK SECTIONS:

Eickmann, K. et al., A Review of United States Air Force and Department of Defense Aerospace Propulsion Needs, National Research Council, The National Academies Press, Washington, D.C., 2006, ISBN-13 978-0-309-10247-6, 264 pages.

Refereed Journal Publications:

- "Experimental Validation of a Pulse Modulated Flow Control Actuator for Turbomachinery," Journal of Propulsion and Power, doi10.2514/1.B36258 by S. Johnson, F. L. Carpenter^{*1}, O. K. Rediniotis and P. G. A. Cizmas.
- "Macro-Scale Fracture Analysis of Isothermal Composites: Theory and Seven Applications," *Engineering Fracture Mechanics*, 163, 366-380 (2016) doi:10.1016/j.engfracmech.2016.06.003 by J. C. Slattery and P. G. A. Cizmas.
- "Creating Reduced Kinetics Models that Satisfy the Entropy Inequality," Journal of Engineering for Gas Turbines and Power Transactions of the ASME, 137, 071504-1–9 (2015) by N. H. Jones, P. G. A. Cizmas and J. C. Slattery.
- "The Use of Dynamic Basis Functions in Proper Orthogonal Decomposition," Journal of Fluids and Structures, 54, 332-360 (2015) by B. A. Freno*, N. R. Matula*, R. L. Fontenot* and P. G. A. Cizmas.
- "A Proper Orthogonal Decomposition Method for Nonlinear Flows with Deforming Meshes," International Journal of Heat and Fluid Flow, 50, 145–159 (2014) by B. A. Freno* and P. G. A. Cizmas.
- "Transonic Aeroelastic Instability Suppression for a Swept Wing by Targeted Energy Transfer," *Journal of Aircraft*, **51**, 1467–1482 (2014) by S. A. Hubbard, R. L. Fontenot^{*}, D. M. McFarland, P. G. A. Cizmas, L. A. Bergman, T. W. Strganac and A. F. Vakakis.
- 7. "A Numerical Investigation of Actively Cooled Structures in Hypersonic Flow," *Journal of Aircraft*, **51**, 1522–1531 (2014) by R. L. Brown^{*}, K. Das, P. G. A. Cizmas and J. D. Whitcomb.
- "Using Proper Orthogonal Decomposition to Model Off-reference Flow Conditions," International Journal of Non-Linear Mechanics, 54, 76–84 (2013) by B. A. Freno*, T. A. Brenner* and P. G. A. Cizmas.
- "A Reduced-Order Model for Heat Transfer in Multiphase Flow and Practical Aspects of the Proper Orthogonal Decomposition," *Computers and Chemical Engineering*, 43, pp. 68–80 (2012) by T. A. Brenner^{*}, and R. L. Fontenot^{*}, P. G. A. Cizmas, T. J. O'Brien and R. W. Breault.

^{1*} indicates Paul Cizmas' students

- "An Investigation into the Significance of the Non-Linear Terms in the Equations of Motion for a Cantilevered Beam," *International Journal of Non-Linear Mechanics*, 47, 84–95 (2012) by B. A. Freno^{*} and P. G. A. Cizmas.
- "A Coordinate Transformation for Unsteady Boundary Layer Equations," *INCAS Bulletin*, 3, Issue 4, 35–45 (2011) by P. G. A. Cizmas.
- "Role of Differential Entropy Inequality in Chemically Reacting Flows," *Chemical Engineering Science*, 66, 5236–5243 (2011) by J. C. Slattery, P. G. A. Cizmas, A. N. Karpetis and S. B. Chambers*.
- "A Computationally Efficient Non-Linear Beam Model," International Journal of Non-Linear Mechanics, 46, 854–869, (2011) by B. A. Freno* and P. G. A. Cizmas.
- "Prediction of Aeroacoustic Resonance in Cavities of Hole-Pattern Stator Seals," Journal of Engineering for Gas Turbines and Power - Transactions of the ASME, 133(2), 022504 (2011) by D. N. Liliedahl*, F. L. Carpenter* and P. G. A. Cizmas.
- "Augmented Proper Orthogonal Decomposition for Problems with Moving Discontinuities," *Powder Technology*, 203, 78–85 (2010) by T. A. Brenner*, R. L. Fontenot*, P. G. A. Cizmas, T. J. O'Brien and R. W. Breault.
- "A Parallel Multigrid Algorithm for Aeroelasticity Simulations," Journal of Aircraft, 47, 53–63 (2010) by P. G. A. Cizmas, J. I. Gargoloff*, T. W. Strganac and P. S. Beran.
- "Recent Developments in Numerical Simulation of Nonlinear Aeroelastic Phenomena" Acta Technica Napocensis - Series: Applied Mathematics and Mechanics, 52, Vol. II, 13–18 (2009) by P. G. A. Cizmas.
- "Numerical and Experimental Investigation of a Serpentine Inlet Duct," International Journal of Computational Fluid Dynamics, 23, 245–258 (2009) by A. M. Kirk, J. I. Gargoloff*, O. K. Rediniotis and P. G. A. Cizmas.
- "Acceleration Techniques for Reduced-Order Models Based on Proper Orthogonal Decomposition," *Journal of Computational Physics*, **227**, 7791–7812 (2008) by P. G. A. Cizmas, B. R. Richardson*, T. A. Brenner*, T. J. O'Brien and R. W. Breault.
- "Mesh Generation and Deformation Algorithm for Aeroelasticity Simulations," Journal of Aircraft, 45, 1062–1066 (2008) by P. G. A. Cizmas and J. I. Gargoloff*.
- 21. "Reduction of Jet Engine Thermal Signature," International Journal of Turbo and Jet Engines, 25, 1–12 (2008) by J. Guarnieri^{*} and P. G. Cizmas.
- "Dimensionless Correlation for Sand Erosion of Families of Polymers," Wear, 262, 316–319 (2007) by P. G. Cizmas and J. C. Slattery.
- "The Influence of In Situ Reheat on Turbine-Combustor Performance," ASME Journal of Engineering for Gas Turbines and Power, 128, 560–572 (2006) by S. B. Chambers*, H. Flitan, P. Cizmas, D. Bachovchin, T. Lippert and D. Little.
- 24. "A Reduced Order Model for a Bubbling Fluidized Bed based on Proper Orthogonal Decomposition," *Computers and Chemical Engineering*, **30**, 243–259 (2005) by T. Yuan*, P. G. Cizmas and T. O'Brien.
- "Experimental Analysis and Visualization of Spatio-Temporal Bubble Patterns in Spouted Fluidized Beds," *Chaos*, 14, 499–509 (2004) by A. Palacios, C. Finney, P. G. A. Cizmas, S. Daw and T. O'Brien.

- "Numerical Simulation of Combustion and Rotor-Stator Interaction in a Turbine-Combustor," *International Journal of Rotating Machinery*, 9, 363–374 (2003) by D. D. Isvoranu and P. G. A. Cizmas.
- 27. "The Accurate Element Method: A new paradigm for numerical solution of ordinary differential equations," *Proceedings of the Romanian Academy, Series A*, **3**, 1–7 (2003) by M. Blumenfeld and P. Cizmas (communicated by Academician R. Voinea).
- "Proper Orthogonal Decomposition of Spatio-Temporal Patterns in Fluidized Beds," *Chem*ical Engineering Science, 58, 4417–4427 (2003) by P. G. A. Cizmas, A. Palacios, T. O'Brien and M. Syamlal.
- "The Effects of Vibrating Blades on Turbomachinery Rotor-Stator Interaction," International Journal of Turbo & Jet-Engines, 20, 17–39 (2003) by J. Collard* and P. G. A. Cizmas.
- "Proper Orthogonal Decomposition of Turbine Rotor-Stator Interaction," AIAA Journal of Propulsion and Power, 19, 268–281 (2003) by P. G. A. Cizmas and A. Palacios.
- "Prediction of Axial Thrust Load in Centrifugal Compressors," International Journal of Turbo & Jet-Engines, 20, 1–16 (2003) by Z. Han and P. G. A. Cizmas.
- "The Accurate Element Method: A Novel Method for Integrating Ordinary Differential Equations," Advances in the Astronautical Sciences, 115, 446–461 (2003) by M. Blumenfeld and P. Cizmas.
- "A 3-D Hybrid Mesh Generation for Turbomachinery Cascades," AIAA Journal of Propulsion and Power, 18, 536–543 (2002) by K. S. Kim* and P. G. A. Cizmas.
- 34. "Optimal Placement of Cooling Flow Tubes in a Wall Heated from the Side," International Journal of Transport Phenomena, **3**, pp. 331-343 (2001) by P. G. A. Cizmas and A. Bejan.
- "A Parallel Algorithm for Simulation of Unsteady Flows in Multistage Turbomachinery," International Journal of Turbo and Jet Engines, 18, 117–131 (2001) by P. G. A. Cizmas and R. Subramanya.
- "Influence of Inter-Row Gap Value on Turbine Losses," International Journal of Rotating Machinery, 7, 335–349 (2001) by P. G. A. Cizmas, C. R. Hoenninger*, S. Chen and H. F. Martin.
- "Full-Annulus Simulations of Airfoil Clocking in a Compressor at Off-Design Operating Conditions," *International Journal of Turbo & Jet-Engines*, **17**, 95–117 (2000) by D. J. Dorney, S. L. Sondak, P. G. A. Cizmas, V. E. Saren and N. M. Savin.
- "The Influence of Clocking on Unsteady Forces of Compressor and Turbine Blades," International Journal of Turbo & Jet-Engines, 17, 133–142 (2000) by P. G. A. Cizmas and D. J. Dorney.
- "Effects of Hot Streak/Airfoil Ratios in a High-Subsonic Single-Stage Turbine," International Journal of Turbo and Jet Engines, 17, 119–132 (2000) by D. J. Dorney, D. L. Sondak and P. G. A. Cizmas.
- "Parallel Computation of Turbine Blade Clocking," International Journal of Turbo & Jet-Engines, 16, 49–60 (1999) by P. Cizmas and D. J. Dorney.
- "Reduced-Order Modeling of Unsteady Viscous Flow in a Compressor Cascade," AIAA Journal, 36, 1039–1048 (1998) by R. Florea, K. C. Hall and P. G. A. Cizmas.
- 42. "Flow About a Slotted Cylinder-Airfoil Configuration in a Wind Tunnel," Journal of Aircraft, 33, 716–721 (1996) by P. Cizmas, D. M. Tang and E. H. Dowell.

- 43. "Experiments and Analysis of Gust Generator in a Wind Tunnel," *Journal of Aircraft*, **33**, 139–148 (1996) by D. M. Tang, P. Cizmas and E. H. Dowell,
- "Computation of Steady and Unsteady Viscous Flows Using a Simultaneously Coupled Inviscid-Viscous Interaction Technique," Journal of Fluid and Structures, 9, 639–657 (1995) by P. Cizmas and K. C. Hall.
- "Conformal Mapping Extension of Cascade Plates to Cascade Airfoils of a Given Shape," Journal of the Romanian Academy, Studii si Cercetari de Mecanica Aplicata, 49(5-6), 467–476 (1990) by C. Berbente and P. Cizmas.
- 46. "Axial Symmetrically Loaded Discs and Plates Calculated by the Three Unknowns Method," Journal of the Romanian Academy, Studii si Cercetari de Mecanica Aplicata, 49(1), 71–84 (1990) by P. Cizmas.
- "Velocity Distribution on Autovehicle Contour Through Numerical Simulation," Bul. Inst. Politeh. Ser. Transp. Aeronave, 49, 43–50 (1987) by M. Oprean, P. Cizmas and F. Stoenescu.

CONFERENCE PUBLICATIONS:

- 1. "Numerical Investigation of the Effect of Geometric Design Parameters on Swirl Brake Performance," *SciTech 2017*, Grapevine, Texas by N. R. Matula and P. G. A. Cizmas.
- 2. "Effect of Gradient Reconstruction Method on Transonic Fan Performance," *SciTech 2017*, Grapevine, Texas by F. Carpenter and P. G. A. Cizmas.
- "A Reduced-Order Model for Turbomachinery Aeroelastic Analysis Based on the Zeta-Coordinate," *Propulsion Safety and Sustainment Conference*, Grapevine, Texas (2016) by P. G. A. Cizmas.
- 4. "Numerical Investigation of the Effects of Swirl Brake Design on Labyrinth Seal Leakage Flow," Society of Engineering Science, College Station, Texas (2015) by N. Matula and P. G. A. Cizmas.
- "Modeling of Unsteady Flows Using Reduced-Order Models Based on the Proper Orthogonal Decomposition," *International Conference of Aerospace Sciences "AEROSPATIAL 2014"*, Bucharest, Romania (2014) by T. A. Brenner*, F. L. Carpenter*, B. A. Freno*, R. L. Fontenot* and P. G. A. Cizmas.
- "Creating Reduced Kinetics Models that Satisfy the Entropy Inequality," ASME Turbo Expo 2014, GT2014-25694, Dusseldorf, Germany (2014) by N. H. Jones^{*}, P. G. A. Cizmas and J. C. Slattery.
- 7. "The Use of Dynamic Basis Functions in Proper Orthogonal Decomposition," SciTech 2014, AIAA-2014-1436, National Harbor, Maryland (2014) by B. A. Freno*, N. R. Matula*, R. L. Fontenot* and P. G. A. Cizmas.
- "A Reduced-Order Model for Turbomachinery Flows using Proper Orthogonal Decomposition," *Proceedings of the ASME Turbo Expo 2013*, San Antonio, Texas, June 3-7, 2013 by T. A. Brenner^{*}, F. L. Carpenter^{*}, B. A. Freno^{*} and P. G. A. Cizmas.
- "A Proper Orthogonal Decomposition Method for Nonlinear Flows with Deforming Meshes," 51st AIAA Aerospace Sciences Meeting, Grapevine, Texas, January 7-10, 2013 by B. A. Freno* and P. G. A. Cizmas.

- "Aeroelastic Simulation of Structures in Hypersonic Flow," 53rd Structures, Structural Dynamics, and Materials Conference, Honolulu, Hawaii, April 23-26, 2012 by R. L. Brown*, K. Das, P. G. A. Cizmas and J. Whitcomb.
- "Proper Orthogonal Decomposition Applied to the Reynolds-Averaged Navier-Stokes Equations," 50th AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, AIAA-2012-314, Nashville, Tennessee, Jan. 9-12, 2012 by B. A. Freno*, T. A. Brenner* and P. G. A. Cizmas.
- "Stability Enhancement of a Transonic Wing Using a Simple Passive Attachment," AIAA Atmospheric Flight Mechanics Conference, Portland, Oregon, Aug. 8-11, 2011 by S. Hubbard, D. M. McFarland, A. F. Vakakis, L. A. Bergman, R. L. Fontenot^{*}, R. L. Brown^{*}, P. G. A. Cizmas and T. W. Strganac.
- "Assessment of the Numerical Modeling of a Transonic Wing Aeroelastic Response," International Forum on Aeroelasticity and Structural Dynamics, Paris, France, June 2011 by R. L. Fontenot^{*}, S. Hubbard, R. L. Brown^{*}, D. M. McFarland, P. G. A. Cizmas, A. Vakakis and L. Bergman.
- 14. "A Reduced-Order Model of the Reynolds-averaged Navier-Stokes Equations Based on the Proper Orthogonal Method," *Propulsion Safety and Affordable Readiness Conference*, Jacksonville, FL, March 2011 by T. Brenner^{*} and P. G. A. Cizmas.
- 15. "The Role of Structural Nonlinearities in Wind Turbine Blade Aeroelastic Analysis," AIAA Paper 2011-995, 49th AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, Orlando, Florida, Jan. 4-7, 2011 by B. A. Freno^{*}, R. L. Brown^{*} and P. G. A. Cizmas.
- "Prediction of Aeroacoustic Resonance in Cavities of Hole-Pattern Stator Seals," GT2010-23218, ASME Turbo Expo 2010: Power, Sea and Air, Glasgow, UK, June 2010 by D. N. Liliedahl^{*}, F. L. Carpenter^{*} and P. G. A. Cizmas.
- "Turbomachinery Aeroelastic Analysis Using Proper Orthogonal Decomposition Method," *Propulsion - Safety and Affordable Readiness Conference*, Jacksonville, FL, March 2010 by P. G. A. Cizmas.
- "A High-Fidelity Nonlinear Aeroelastic Model for Aircraft with Large Wing Deformation," International Forum on Aeroelasticity and Structural Dynamics, Seattle, WA, June 2009 by P. G. A. Cizmas, B. A. Freno*, T. A. Brenner* and G. D. Worley*.
- "Aeroelastic Analysis of a Transonic Wing for Design of Local Nonlinear Attachments," AIAA Paper 2009-2365, 50th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, May 2009 by D. M. McFarland, P. Cizmas, T. Strganac, L. Bergman, Y. Lee, A. Vakakis and S. Hubbard.
- "Internal Plenum Design and Testing for an Oscillatory Blowing Stall Suppression System," AIAA Paper 2009-1242, 47th AIAA Aerospace Sciences Meeting, Orlando, FL, Jan. 2009 by F. Carpenter^{*}, S. Johnson, P. G. A. Cizmas and O. Rediniotis.
- "Prediction of Fluid Instabilities in Hole-Pattern Stator Seals," AIAA Paper 2009-786, 47th AIAA Aerospace Sciences Meeting, Orlando, FL, Jan. 2009 by D. Liliedahl* and P. G. A. Cizmas.
- 22. "Practical Aspects of the Implementation of Proper Orthogonal Decomposition," AIAA Paper 2009-918, 47th AIAA Aerospace Sciences Meeting, Orlando, FL, Jan. 2009 by T. Brenner*, P. G. A. Cizmas, T. O'Brien and R. Breault.

- "Single-Stage Axial Compressor for the Study of Rotating Stall Suppression," AIAA Paper 2008-4994, 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Hartford, CT, 21-23 July 2008 by F. Carpenter^{*}, S. Johnson, P. G. A. Cizmas and O. Rediniotis.
- 24. "A Numerical Method for Nonlinear Aeroelastic Analysis of Wings with Large Deformation," *International Forum on Aeroelasticity and Structural Dynamics*, Stockholm, Sweden, June, 2007 by P. G. A. Cizmas, J. I. Gargoloff*, T. W. Strganac and P. S. Beran.
- "An Acceleration Approach for Reduced-Order Models Based on Proper Orthogonal Decomposition," AIAA Paper 2007-713, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January, 2007 by P. G. A. Cizmas.
- "Mesh Generation and Deformation Algorithm for Aeroelasticity Simulations," AIAA Paper 2007-556, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January, 2007 by J. I. Gargoloff* and P. G. A. Cizmas.
- 27. "A Parallel Multigrid Algorithm for Aeroelasticity Simulations," AIAA Paper 2007-330, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January, 2007 by J. I. Gargoloff*, P. G. A. Cizmas, T. W. Strganac and P. S. Beran.
- "Numerical and Experimental Investigation of a Serpentine Inlet Duct," AIAA Paper 2007-842, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January, 2007 by A. M. Kirk, A. Kumar, J. I. Gargoloff*, O. K. Rediniotis and P. G. A. Cizmas.
- "Parallel Algorithm for Fully Nonlinear Aeroelastic Analysis," AIAA Paper 2006-2073, 47th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, Newport, RI, May, 2006 by J. Gargoloff*, P. G. Cizmas, T. W. Strganac and P. Beran.
- "Dimensionless Parameters for Modeling Sand Particle Erosion of Polyurethane Coatings," 9th Joint FAA/DOD/NASA Conference on Aging Aircraft, Atlanta, Georgia, March 2006 by J. C. Slattery and P. G. A. Cizmas.
- "Aeroelastic Analysis for Future Air Vehicle Concepts Using a Fully Nonlinear Methodology," AIAA Paper 2005-2171, 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, Austin, Texas, 18-21 April, 2005 by T. W. Strganac, P. G. Cizmas, C. Nichkawde, J. Gargoloff* and P. Beran.
- 32. "Numerical and Experimental Investigation of In Situ Reheat," Turbine Engine Technology Symposium, Dayton, OH, 30 August - 2 September, 2004 by P. G. A. Cizmas and T. Lippert.
- 33. "The influence of in situ reheat on turbine-combustor performance," ASME Paper 2004-GT-54071, 49th ASME International Gas Turbine Congress, Vienna, Austria, 14-17 June, 2004 by S. Chambers*, H. Flitan, P. G. A. Cizmas, T. Lippert, D. Bachovchin and D. Little.
- 34. "Analysis of Unsteady Aerodynamics Effects in a Turbine-Combustor," 10th International Symposium on Unsteady Aerodynamics, Aeroacoustics, & Aeroelasticity of Turbomachines, Durham, North Carolina, 7-11 September, 2003 by P. G. A. Cizmas, H. Flitan, T. Lippert, D. Bachovchin and D. Little.
- 35. "A Novel Method for Integrating Ordinary Differential Equations," *John Junkins Astrodynamics Symposium*, College Station, Texas, 23-24 May, 2003 by P. G. A. Cizmas and M. Blumenfeld.
- 36. "Numerical Prediction of Unsteady Blade Loading in a Turbine-Combustor," 8th National Turbine Engine High Cycle Fatigue Conference, Monterey, California, 14-16 April, 2003 by P. G. A. Cizmas, H. Flitan and D. D. Isvoranu.

- 37. "Numerical Simulation of Combustion and Rotor-Stator Interaction in a Turbine-Combustor," The Ninth International Symposium on Transport Phenomena and Dynamics of Rotating Machinery (ISROMAC-9), Honolulu, Hawaii, February 10-14, 2002 by D. D. Isvoranu and P. G. A. Cizmas.
- 38. "A 3-D Hybrid Mesh Generation for Turbomachinery Cascades," AIAA Paper 2001-3209, 37th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Salt Lake City, Utah, 8-11 July 2001 by K. S. Kim* and P. G. A. Cizmas.
- "The Influence of Blade-forced Vibration on Turbine Rotor-Stator Interaction," AIAA Paper 2001-3472, 37th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Salt Lake City, Utah, 8-11 July 2001 by J. Collard* and P. G. A. Cizmas.
- "A CFD Method for Axial Thrust Load Prediction of Centrifugal Compressors," ASME Paper 2001-GT-0568, 46th ASME International Gas Turbine Congress, New Orleans, Louisiana, June 4-7, 2001 by Z. Han and P. G. A. Cizmas.
- "LES Calibration of a Turbulent Potential Model for Turbomachinery Flows," AIAA Paper 2000-3203, 36th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Huntsville, Alabama, July 2000 by S. M. Mitran and P. G. A. Cizmas.
- 42. "Influence of Inter-Row Gap Value on Turbine Losses," *The Eight International Symposium* on Transport Phenomena and Dynamics of Rotating Machinery (ISROMAC-8), Honolulu, Hawaii by P. G. A. Cizmas, C. R. Hoenninger^{*}, S. Chen and H. F. Martin.
- 43. "The Influence of Clocking on Unsteady Forces of Compressor and Turbine Blades," The Fourteenth International Symposium on Airbreathing Engines, Florence, Italy, September 1999 by P. G. A. Cizmas and D. J. Dorney.
- 44. "Full-Annulus Simulations of Airfoil Clocking in a 1-1/2 Stage Axial Compressor," ASME Paper 99-GT-023, *International Gas Turbine and Aeroengine Conference*, Indianapolis, Indiana, June 1999 by D. J. Dorney, D. L. Sondak, P. G. A. Cizmas, V. E. Saren and N. M. Savin.
- 45. "Full-Annulus Simulations of Airfoil Clocking in a Compressor at Off-Design Operating Conditions," AIAA Paper 99-2383, 35th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Los Angeles, June 1999 by D. J. Dorney, D. L. Sondak, P. G. A. Cizmas, V. E. Saren and N. M. Savin.
- 46. "Effects of Hot Streak/Airfoil Ratios in a High-Subsonic Single-Stage Turbine," AIAA Paper 99-2384, 35th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Los Angeles, Jun. 1999 by D. J. Dorney, D. L. Sondak and P. G. A. Cizmas.
- "Parallel Computation of Turbine Blade Clocking," Paper AIAA 98-3598, 34th AIAA/ASME-/SAE/ASEE Joint Propulsion Conference, Cleveland, Ohio, July 13-15, 1998 by P. Cizmas and D. J. Dorney.
- 48. "Eigenmode Analysis of Unsteady Viscous Flows in Turbomachinery Cascades," The Eighth International Symposium on Unsteady Aerodynamics and Aeroelasticity of Turbomachines, Stockholm, Sweden, September 14-18, 1997 by R. Florea, K. C. Hall and P. Cizmas.
- "Parallel Computation of Rotor-Stator Interaction," The Eighth International Symposium on Unsteady Aerodynamics and Aeroelasticity of Turbomachines, Stockholm, Sweden, September 14-18, 1997 by P. Cizmas and R. Subramanya.

- "Reduced-Order Modeling of Unsteady Viscous Flow in a Compressor Cascade," AIAA Paper 96-2572, 32th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, July 1-3, 1996, Lake Buena Vista, FL by R. Florea, K. C. Hall and P. G. A. Cizmas.
- "Aerodynamics of a Rotating Slotted Cylinder and its Applications," *Third International Colloquium on Bluff Body Aerodynamics and Applications*, Blacksburg, VA, July 28-August 1, 1996 by D. M. Tang, P. Cizmas and E. H. Dowell.
- 52. "A Viscous-Inviscid Model of Unsteady Small Disturbance Flows in Cascades," Paper AIAA 95-2655, 31st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, San Diego, CA, July 10-13, 1995 by P. Cizmas and K. C. Hall.
- 53. "Simultaneous Method to Calculate Interacting Boundary Layers Using a Solid Body Model," AIAA Paper 95-2154, 26th AIAA Fluid Conference, San Diego, CA, June 19-22, 1995 by P. Cizmas.
- 54. "Disc Shape Optimization Using the Three Unknowns Method," Proceedings of the International Conference OPTI-91, Boston, MA, June 1991 by P. Cizmas.
- 55. "Expert System for the Aerodynamical Study of Car Shape," Proceedings of the International Conference OPTI-89, Southampton, U.K., 1989 by P. Cizmas, P. Jebelean, M. Oprean and D. Serban.
- "Computation Through Numerical Simulation of Vehicle Aerodynamic Characteristics," Proceedings of ISATA, Vol. II, No. 87183, Munich, West Germany, 1987 by P. Cizmas, P. Jebelean, M. Oprean and F. Stoenescu.
- 57. "Application of Symbolic Logic to the Morphometric Study of Coronary Diabetic Microangiopathy," *The First International Symposium for Science on Form*, Tsukuba, Japan, 1985 by I. Basca, C. Vasilescu and P. Cizmas.

TEACHING

COURSES TAUGHT AT TEXAS A&M UNIVERSITY

- Aerothermodynamics and Propulsion AERO351 (undergraduate)
- Aerospace Propulsion AERO417 (undergraduate)
- Heat Transfer and Viscous Flows AERO452 (undergraduate)
- Introduction to Computational Fluid Dynamics AERO489 (undergraduate)
- Numerical Methods for Internal Flow AERO615 (graduate)
- Unsteady Aerodynamics AERO620 (graduate)

MENTORED STUDENT AND POSTDOCTORAL RESEARCH

UNDERGRADUATE STUDENTS (the following list includes only students who wrote a research report; more undergraduate students participated in research projects as student workers or student technicians)

- 1. James Felderhoff, "A ζ -Variable Proper Orthogonal Decomposition Reduced-Order Model of Flow through Nozzles," Summer 2016.
- 2. Ral Bielawski, "Methane Ingestion in Jet Engines," College of Engineering Undergraduate Summer Research Fellow, Summer 2015.
- 3. Francois Rice, "Verification and Validation of the Numerical Accuracy of a 3D Unstructured Finite Volume Flow Solver," College of Engineering Undergraduate Summer Research Fellow, Summer 2014.
- 4. Maytee Vipavayangku Chantharayukhont, "Graphical User Interface for a CFD Flow Solver," College of Engineering Undergraduate Summer Research Fellow, Summer 2013.
- 5. Cory Mikida, "Assessment and Modification of Continuation Software Packages for Aerospace Applications," College of Engineering Undergraduate Summer Research Fellow, Summer 2012.
- 6. Steven Anderson, "Analysis of a Computational Method to Compute Force and Moment Coefficients on Airfoils in Cascade," College of Engineering Undergraduate Summer Research Fellow, Summer 2011.
- 7. Meghan Patzke, "Thermal choking of a turbine with in situ reheat," College of Engineering Undergraduate Summer Research Fellow, Summer 2007.
- 8. Will Carter, "Implicit algorithm for simulation of flow around wings with large deformation," College of Engineering Undergraduate Summer Research Fellow, Summer 2007.
- 9. Douglas Breden, "Numerical Simulation of Flapping Wing Micro Air Vehicles," College of Engineering Undergraduate Summer Research Fellow, Summer 2006.
- 10. Grant Whittington, "Fabrication of non-metallic compressor blades," College of Engineering Undergraduate Summer Research Fellow, Summer 2005.
- 11. David Padilla, "Turbine-combustor for power generation," College of Engineering Undergraduate Summer Research Fellow, Summer 2005.
- 12. Travis Essl, "Design of a jet engine compressor rotor blade," College of Engineering Undergraduate Summer Research Fellow, Summer 2005.

- 13. Jason Sulak, "Cooling of Jet Engine Exhaust Gases Using Water Injection," College of Engineering Undergraduate Summer Research Fellow, Summer 2004.
- 14. Jason Sulak, "Rotating Stall Suppression Using Dimples and Vortex Generating Jets," College of Engineering Undergraduate Summer Research Fellow, Summer 2003.
- 15. Jason Guarnieri, "Design of a $1\frac{1}{2}$ -Stage Compressor Test Rig," Summer 2002.
- 16. Hayden Belobrajdic, "Numerical Analysis of *In Situ* Reheat in Gas Turbine Engines," College of Engineering Undergraduate Summer Research Fellow, Summer 2002.
- Chad Mulholland, "Study of Boundary Layer on a High-Pressure Turbine Blade," AERO 485-325 project, Spring 2001.
- 18. Corbett Hoenninger, "Effect of Airfoil Clocking on the Turbine Blade Loading," TEES Undergraduate Summer Research Fellow, Summer 1999. Corbett won the prize for the best presentation.

MASTERS STUDENTS

- Allen Ream, "Reduced Chemical Kinetics Models Compliant with the Entropy Inequality," 8/2013-8/2015.
- Nathan Jones, "The Importance of the Entropy Inequality on Numerical Simulation using Reduced Methane-Air Reaction Mechanisms," 6/2010-8/2012; currently Engineer at U. S. Navy Naval Air Systems Command.
- Raymond Fontenot, "Advances in Reduced-Order Modeling Based on Proper Orthogonal Decomposition for Single and Two-Phase Flows," 7/2008-12/2010.
- Brian Freno, "An Efficient Nonlinear Structural Dynamics Solver For Use In Computational Aeroelastic Analysis," 1/2009-5/2010.
- Will Carter, "Implementation of a Lower-Upper Symmetric Gauss-Seidel Implicit Scheme for a Navier-Stokes Flow Solver," 5/2008-5/2010.
- 6. Gregory Worley, "Conformal mapping grid generation method for modeling high-fidelity aeroelastic simulations," 5/2007-5/2010; currently Engineer at Beechcraft Corporation.
- Brian Richardson, "A Reduced-Order Model of Non-isothermal, Two-phase Flows," 6/05-5/08; currently Aerospace Engineer, Marshall Space Flight Center, Huntsville, AL.
- Jason Guarnieri "Thermal Signature Reduction Through Liquid Nitrogen and Water Injection," 1/03-12/04; currently Aerospace Engineer, Air Force Research Laboratory, Space Vehicles Directorate, Kirtland AFB, NM.
- 9. Steven Chambers, "Investigation of Combustive Flows Dynamic Meshing in Computational Fluid Dynamics," 8/02-12/04; currently Engineer at Aerovironment, Monrovia, CA.
- Tao Yuan, "A Low Order Model of Two-Phase Flow, Heat Transfer and Combustion," 8/01-9/03; currently Associate Professor at Ohio University, Athens, OH.
- Corbett Hoenninger, "Numerical Simulation of the Impeller Tip Clearance Effect on Centrifugal Compressor Performance," 8/00-12/01; currently Engineer at United Space Alliance, Houston, TX.
- 12. Joseph Collard, III, "Blade-Forced Vibration Effects in Turbomachinery Rotor-Stator Interaction," 8/98-12/00; currently Engineer at Lockheed Martin in Forth Worth, TX.

DOCTORAL STUDENTS

- 1. Elizabeth Krath, "A ζ -Variable POD-based Reduced-Order Model for Turbomachinery Aeroelastic Response," 6/2016-present.
- 2. Raymond Fontenot, "Unstructured Higher-Order Finite Volume Implicit Large-Eddy Simulations for Turbomachinery Applications," 1/2011-present.
- 3. Neil Matula, "Modeling of Fluid-Structure Interaction of Rotating Blades," 9/2010-present.
- Robert Brown, "Numerical Simulation of Hypersonic Aerothermoelastic Phenomena," 9/2009-5/2016; Assistant Professor (starting 8/2016), Abilene Christian University.
- 5. David Liliedahl, "A Time-Linearized and Full-Order Navier-Stokes Solver for Annular Gas Seal Rotordynamic Analysis," 9/2007-present; currently at Rolls-Royce, Indianapolis, IN.
- 6. Forrest Carpenter, "Practical Aspects of Computational Fluid Dynamics for Turbomachinery," 9/2007-5/2016; continuing as a Postdoctoral Researcher.
- Michael Joly, "An Optimization Technique for Multi-Disciplinary Design of Contra-Rotating and Transonic Turbomachinery Components," 1/2011-6/2014; currently at UTRC, East Hartford, CT.
- 8. Brian Freno, "Reduced-Order Modeling for Computational Aeroelasticity," 6/2010-12/2013; currently at Sandia National Laboratories, Albuquerque, NM.
- 9. Thomas Brenner, "Proper Orthogonal Decomposition of Two-phase Flows," 6/2006-5/2011; currently at General Electric, Evandale, OH.
- Joaquin Ivan Gargoloff, "A Numerical Method for Fully Nonlinear Aeroelastic Analysis," 8/02-12/06; currently Application Engineer, Exa Corporation, Burlington, MA.
- Celerino Resendiz, "Numerical Simulation of Flow Separation Control by Oscillatory Fluid Injection," 8/98-5/05, currently Assistant Professor, National Polytechnic Institute, Mexico D.F., Mexico.
- Kyu-sup Kim, "Three-dimensional Hybrid Grid Generator and Unstructured Flow Solver for Compressors and Turbines," 8/98-11/03; currently Senior Research Engineer at the Research & Development Division for Hyundai Motor Company and Kia Motors Corporation, South Korea.

Postdoctoral Researchers

- 1. Forrest Carpenter, "Limiters for CFD of Turbomachinery Flows," 9/2016-present.
- 2. Thomas Brenner, "Reduced-Order Modeling of Turbomachinery Flows," 6/2011-1/2013.
- 3. Horia Flitan, "Effect of In Situ Reheat in a Multi-Stage Turbine-Combustor," 8/02-12/03.
- 4. Dragos Isvoranu, "Numerical Algorithm for Coupling the Reynolds-Averaged Navier-Stokes Equations and Species Conservation Equations," 11/00-12/01.
- 5. Zhenxue Han "Numerical Prediction of Axial Load Thrust in Centrifugal Compressors," 2/00-8/00.

SERVICE

PROFESSIONAL ACTIVITIES:

- Appointed to the National Research Council Committee on Air Force/Department of Defense Aerospace Propulsion (2005).
- Taught a section of the AIAA Aeroelasticity Short Course (this course is taught every other year at the Structures, Structural Dynamics and Materials Conference).
- Associate Editor for Computational and Applied Mathematics.
- Member of the editorial board:
 - 1. Propulsion and Power Research
 - 2. FME Transactions
 - 3. INCAS Bulletin

Membership in Professional Societies

- American Society of Mechanical Engineers, Fellow
- American Institute of Aeronautics and Astronautics, Associate Fellow

CHAIR OF TECHNICAL MEETINGS:

- Session Chair for Aerodynamics, International Conference of Aerospace Sciences "AEROSPA-TIAL 2014", Bucharest, Romania, September 2014
- Session Chair for CFD Methods, SciTech 2014, National Harbor, Maryland, January 2014
- Session Chair for Optimization and Multidisciplinary Analysis, The 53rd ASME/IGTI Turbo Expo, Berlin, Germany, June 2008
- Session Chair for Aeroelasticity, The 44th Annual Technical Meeting, Society of Engineering Science, College Station, Texas, October 2007
- Session Chair for Forced Response, The 50th ASME/IGTI Turbo Expo, Reno-Tahoe, Nevada, June 2005
- Chairperson for Unsteady Flows in Turbomachinery Cascades, The 9th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery (ISROMAC-9), Honolulu, Hawaii, 2002
- Chairperson of the session CFD-Turbomachinery, The 37th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Salt Lake City, Utah, 2001
- Chairperson for Unsteady Flows in Turbomachines, The 8th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery (ISROMAC-8), Honolulu, Hawaii, 2000
- Co-chairperson at ASME/IGTI International Gas Turbine Congress and Exposition, Indianapolis, Indiana, 1999
- Co-chairperson for Unsteady Flows in Compressors, ASME/IGTI International Gas Turbine Congress and Exposition, Stockholm, Sweden, 1998

REVIEWED PAPERS FOR:

- Journal of Computational Physics
- ASME Journal of Turbomachinery
- ASME Journal of Engineering for Gas Turbines and Power

- ASME Journal of Fluids Engineering
- Journal of Structure and Fluids
- International Journal of Rotating Machinery
- Mathematical and Computer Modelling
- International Journal of Computational Engineering Science
- AIAA Journal of Propulsion and Power
- AIAA Journal
- AIAA Journal of Aircraft
- AIAA Journal of Guidance, Control, and Dynamics
- Aerospace Science and Technology
- Journal of Power and Energy
- Journal of Wind Engineering and Industrial Applications

Reviewed proposals submitted to:

- Air Force Office of Scientific Research
- Executive Agency for Funding of Higher Education, Research, Development and Innovation, UEFISCDI, Romania

UNIVERSITY/COLLEGE/DEPARTMENT SERVICE:

- Texas A&M University: Member of the Resource Allocation Committee of the High Performance Research Computing
- College of Engineering: Promotion and Tenure Committee
- Department: Promotion and Tenure Committee

Seminars or Lectures

- Proper-Orthogonal Decomposition Models for Aeroelastic Analysis, *Florida International University*, Miami, FL, February 2017.
- Reduced-Order Models for Aeroelastic Analysis, University of Illinois at Urbana-Champaign, Urbana-Chapaign, IL, March 2015.
- Constrained Proper-Orthogonal Decomposition, Department of Energy, National Energy Technology Laboratory, Morgantown, WV, October 2014.
- Flow Simulation and Aeroelasticity Research, *Danish Technical University*, Risø, Denmark, October 2013.
- Computational Aspects of Reduced Kinetics Models and Reduced-Order Models, *Lawrence Berkeley National Laboratory*, Berkeley, CA, April, 2013.
- Numerical Simulation of Multi-Physics Phenomena, Army Research Laboratory, Aberdeen, MD, February 2013.
- Recent Advances in Reduced-Order Modeling for Transport Phenomena, *Department of Energy*, *National Energy Technology Laboratory*, Morgantown, WV, August 2011.
- A Short Course on Computational Fluid Dynamics, *Technical University of Cluj-Napoca*, June 2010.

- Acceleration Methods for Unsteady Aerodynamics and Aeroelasticity, *Advanced Structural Mechanics and Computational Mathematics*, University of Campinas (Brazil) and Southern Office of Aerospace Research and Development (a branch of U. S. Air Force Office of Scientific Research), November 2008.
- Reduced-Order Modeling of Turbomachinery Flows, *Romanian Academy*, Bucharest, Romania, September 2008.
- Turbine Combustors: Just Around the Corner? *Swiss Federal Institute of Technology*, Lausanne, Switzerland, August 2007.
- Turbine in-situ Reheat and Reduced-Order Modeling in Turbomachinery, *Department of Mechanical Engineering, Ohio State University*, Columbus, OH, May 2007.
- Parallel Algorithms for Computational Fluid Dynamics and Aeroelastic Analyses, Super Computing Science Consortium (SC)² Computational Sciences Seminar, Waynesburg, PA, July 2006.
- Recent Developments in Turbomachinery Flow Simulation, *Swiss Federal Institute of Technology*, Lausanne, Switzerland, March 2004.
- Accurate Element Method: A Novel Method for Integrating Ordinary Differential Equations, Air Force Research Laboratory, Wright-Patterson AFB, OH, July 2003.
- The Impact of Supercomputing on CFD: from Power Plants to Butterflies, Super Computing Science Consortium (SC)² Computational Sciences Seminar, Waynesburg, PA, July 2003.
- Numerical Simulation of Turbine-Combustors, A New Paradigm in Propulsion, *Gas Turbine Laboratory, MIT*, Boston, MA, Apr. 2002.
- Numerical Prediction of Axial Thrust Load in Centrifugal Compressors, *Honeywell*, Torrance, CA, Jan. 2002.
- Recent Developments for Improving the Efficiency and Accuracy of CFD Methods, *The Boeing Company*, Seattle, WA, Feb. 2001.
- Numerical Simulation of Flow and Combustion in Turbines, *National Energy Technology Laboratory, Department of Energy*, Pittsburgh, PA, Dec. 2000.
- A Reduced Order Model of Two-Phase Flow, Heat Transfer and Combustion in Circulating Fluidized-Beds, *National Energy Technology Laboratory, Department of Energy*, Morgantown, WV, Aug. 2000.
- How to Make CFD a *True* Investigation Tool, *Air Force Research Laboratory*, Wright-Patterson AFB, OH, Aug. 2000.
- Computation of Unsteady Turbomachinery Flows, Centre for Research on Computation and its Applications (CERCA), Montreal, Canada, Oct. 1998.
- Parallel Computation of a Fully Clocked Turbine, NASA Lewis Research Center, Cleveland, OH, Aug. 1998.
- Numerical Simulation of Multistage Turbines, Department of Energy, Federal Energy Technology Center, Morgantown, WV, Aug. 1998.
- Advances in Unsteady Flow Simulation in Turbomachinery, *Texas A&M University* College Station, Texas, Mar. 1998.
- Advances in Unsteady Flow Simulation in Turbomachinery, University of Alabama at Huntsville, Huntsville, Alabama, Feb. 1998.
- Advances in Unsteady Flow Simulation in Turbomachinery, *GMI Institute*, Flint, Michigan, Jan. 1998.
- Parallel Computation of Unsteady Flows in Turbomachinery, *The Pennsylvania State University*, College Park, Pennsylvania, Dec., 1997.

- Recent Advances in Numerical Simulation of Unsteady Flows in Turbomachinery, *Purdue School of Engineering and Technology*, Indianapolis, Indiana, May 1997.
- Numerical Prediction of Stall Flutter and Rotating Stall in Turbomachinery, Western Michigan University, Kalamazoo, Michigan, Nov. 1996.
- Prediction of Stall Flutter Using a Simultaneously Coupled Viscous-Inviscid Model, *The Penn-sylvania State University*, College Park, Pennsylvania, Mar. 1996.
- Numerical Simulation of Stall Flutter in Jet Engines, *AlliedSignal Engines*, Phoenix, Arizona, Oct. 1995.