

# CURRICULUM VITAE

James M. McDonough

## PERSONAL

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Birth Date: December 10, 1945  
Birth Place: Springfield, OH  
Marital Status: Married  
Citizenship: USA

## EDUCATION

B.S. Aeronautical-Astronautical Engineering, Ohio State University (1968)  
M.A. Applied Mathematics, University of California, Los Angeles (1975)  
Ph.D. Engineering, University of California, Los Angeles (1980)  
Dissertation Title: *The Rayleigh-Bénard Problem for a Horizontally Unbounded Domain: Determination of the Wavenumber of Convection*  
Dissertation Committee Chair: Professor Ivan Catton

## PROFESSIONAL EMPLOYMENT

1999–pres: Professor, Departments of Mechanical Engineering and Mathematics, University of Kentucky, Lexington, KY  
1998–1999: Associate Professor, Departments of Mechanical Engineering and Mathematics, University of Kentucky, Lexington, KY  
1990–1998: Associate Professor, Department of Mechanical Engineering, University of Kentucky, Lexington, KY  
1983–1990: Adjunct Assistant Professor, Department of Mechanical, Aerospace and Nuclear Engineering, University of California, Los Angeles, CA  
1980–1983: Visiting Lecturer, Chemical, Nuclear and Thermal Engineering Department, University of California, Los Angeles, CA  
1980–1987: Member of the Technical Staff, Fluid Mechanics Department, The Aerospace Corporation, El Segundo, CA  
1977–1980: Engineer (Post-Graduate Research), University of California, Los Angeles, CA  
1973–1976: Staff Mathematician, Prose, Inc., Los Angeles, CA  
1968–1972: Engineer/Scientist, McDonnell Douglas Astronautics Co., Santa Monica, CA

## PROFESSIONAL ACTIVITIES

### Professional Society Membership

American Association for the Advancement of Science  
American Institute for Aeronautics and Astronautics  
American Mathematical Society  
American Physical Society  
American Society of Mechanical Engineers  
The Combustion Institute  
New York Academy of Sciences  
Society for Industrial and Applied Mathematics

## PROFESSIONAL ACTIVITIES (Cont.)

### Reviewer

Archival Journals:

*AIAA Journal*  
*Combustion and Flame*  
*Combustion Science and Technology*  
*Computers and Fluids*  
*Computers and Mathematics*  
*International Journal for Numerical Methods in Fluids*  
*International Journal of Heat and Fluid Flow*  
*International Journal of Heat and Mass Transfer*  
*Journal of Computational Physics*  
*Journal of Fluids Engineering*  
*Journal of Heat Transfer*  
*Journal of Tribology*  
*Journal of Propulsion and Power*  
*Numerical Heat Transfer*  
*Progress in Computational Fluid Dynamics*

Conferences: AIAA, ASME, Combustion Institute Symposia, International Heat Transfer Conferences, Parallel CFD Conferences

Proposals: NSF, NASA, Army Research Office, Civilian Research and Development Foundation

Member: International Organizing Committee for annual *Parallel CFD Conferences*

### AWARDS/HONORS

Member: Sigma Gamma Tau, Pi Mu Epsilon

Biography Listed in:

*Who's Who in the Frontiers of Science and Technology, 2<sup>nd</sup> Ed.*  
*Who's Who in Science and Engineering, 2<sup>nd</sup>, 8<sup>th</sup>, 9<sup>th</sup> Eds.*  
*Who's Who of Emerging Leaders in America, 2<sup>nd</sup>, 3<sup>rd</sup> Eds.*  
*Who's Who in the West, 21<sup>st</sup>, 22<sup>nd</sup>, 23<sup>rd</sup> Eds.*  
*Who's Who in the South and Southwest 23<sup>rd</sup> Ed.*  
*Who's Who in America 57<sup>th</sup> Ed.*

### AREAS OF RESEARCH SPECIALIZATION

**Computational Fluid Dynamics:** incompressible and compressible viscous flows, including heat transfer, chemical reactions, turbulence simulation and modeling; shock capturing; phase change.

**Computational Numerical Analysis:** particularly solution of ordinary and partial differential equations; solution of sparse linear systems.

**Nonlinear Dynamical Systems:** applications to analysis of fluid flow, especially turbulence modeling and simulation; general applications to data analysis.

**Engineering Applications:** aircraft engine turbine blade cooling, combustor–diffuser flows in gas turbines, H<sub>2</sub>–O<sub>2</sub> and H<sub>2</sub>–air combustion, wildland fire spread, flight insects and micro-air vehicles.

## RESEARCH CONTRACTS/GRANTS

### Awarded

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): None

*Transition to turbulence in pipe and duct flows: A computational fluid dynamics study*

KENTUCKY SPACE GRANT CONSORTIUM

06/01/06 – 05/31/07. (\$5,000) (Fellowship for undergraduate student, Mr. Michael A. Mudd)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): None

*Simulation of Insect Flight—Implications for Micro-Air Vehicles*

KENTUCKY SPACE GRANT CONSORTIUM

08/01/05 – 05/31/06. (\$4,000) (Fellowship for undergraduate student, Mr. Brett G. Compton)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): None

*Subgrid-Scale Models for LES of Compressible Turbulent Combustion*

NASA/EPSCoR

03/01/05 – 03/31/06. (\$24,533)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): None

*Implementation of Discrete Dynamical System SGS Models in New LES Code for Turbulent Combustion*

NASA/EPSCoR

06/01/03 – 05/31/04. (\$24,744)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): None

*Construction of 3-D Discrete Dynamical System Models of Turbulent Combustion*

KENTUCKY SPACE GRANT CONSORTIUM

06/01/01 – 05/31/02. (\$3,500) (Fellowship for undergraduate student, Mr. John C. Holloway)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): None

*Discrete Dynamical Systems Subgrid-Scale Models for Turbulent Combustion*

NASA/EPSCoR

06/01/02 – 05/31/03. (\$24,844)

Principal Investigator: A. Male

Co-Principal Investigator(s): J. M. McDonough, Y. Zhang, K. A. Tagavi

*Liquid Fueled Reusable Ballistic Missile Target (LFRBMT) Lightweight Heat Exchanger*

Truax Engineering, Inc.

05/01/01 – 09/28/01. (\$300,000)

Principal Investigator: K. A. Tagavi

Co-Principal Investigator(s): J. M. McDonough, J. D. Jacob, T.-W. Wu, C. Cremers

*Phase Change and Transport Phenomena in Microgravity*

NASA/EPSCoR

07/01/97 – 06/30/01. (\$368,325)

*Principal Investigator: K. A. Tagavi*

*Co-Principal Investigator(s): J. M. McDonough, J. D. Jacob, T.-W. Wu*

*Supplemental travel and planning grant associated with the above*

06/01/01 – 05/31/02. (\$24,000)

*Principal Investigator: J. D. Jacob*

*Co-Principal Investigator(s): J. M. McDonough*

*Computational and Experimental Study of Gas Turbine Blade Cooling with Dynamical Systems  
Subgrid-Scale Models for Large-Eddy Simulation*

*DEPSCoR/AFOSR*

04/01/00 – 03/31/03. (\$279,966)

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Dynamical Systems Subgrid-Scale Models for Premixed Turbulent Combustion*

*NASA/EPSCoR*

06/01/00 – 05/31/01. (\$14,551)

*Principal Investigator: J. N. Griffioen*

*Co-Principal Investigator(s): K. L. Calvert, Z. Fei\*, C. O. Jaynes, J. M. Mazur, D. Maloney\*,  
J. M. McDonough\*, W. B. Seales*

*The Metaverse: A Laboratory for Digital Media Networks*

*NSF*

10/01/01 – 09/30/06. (\$824,621)

\* *Investigators not appearing in official NSF PI/PD–CO-PI/PD list due to maximum of five allowed, but who contributed equally to proposal preparation and subsequent research with the listed investigators.*

*Principal Investigator: A. M. Wala*

*Co-Principal Investigator(s): J. M. McDonough and J. D. Jacob*

*CFD Analysis of Mine Face Ventilation Systems*

*NIOSH, Department of Health and Human Services, Public Health Service*

07/01/00 – 06/30/01. (\$178,645 funding continuation for year two)

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None.*

*Dynamical Systems Subgrid-Scale Models for Premixed Turbulent Combustion*

*NASA / Kentucky EPSCoR*

06/01/00 – 05/31/01. (\$24,801)

*Principal Investigator: K. A. Tagavi*

*Co-Principal Investigator(s): J. McDonough, K. Saito, T. Wu*

*Phase Change and Transport Phenomena in Microgravity*

*NASA / Kentucky EPSCoR*

07/01/00 – 06/30/01. (\$12,000)

*Principal Investigator: J. D. Jacob*

*Co-Principal Investigator(s): J. M. McDonough*

*Computational and Experimental Study of Aircraft Gas Turbine Engine Combustor Diffusers, Phase II*

*General Electric Aircraft Engines*

*01/01/00 – 12/31/00. (\$64,023)*

*Principal Investigator: A. M. Wala*

*Co-Principal Investigator(s): J. M. McDonough and J. C. Yingling*

*CFD Analysis of Mine Face Ventilation Systems*

*NIOSH, Department of Health and Human Services, Public Health Service*

*08/01/99 – 07/31/02. (\$417,882; first-year funding \$142,232)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Subgrid-Scale Modeling of Turbulent Combustion via Discrete Dynamical Systems*

*NASA/EPSCoR*

*06/01/99 – 05/31/00. (\$23,953)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): J. D. Jacob*

*Computational and Experimental Study of Aircraft Gas Turbine Engine Combustor Diffusers, Phase I*

*General Electric Aircraft Engines*

*01/01/99 – 12/31/99. (\$19,550)*

*Principal Investigator: K. A. Tagavi*

*Co-Principal Investigator(s): C. Cremers, J. Jacob, J. McDonough, K. Saito, T. Wu*

*Phase Change and Transport Phenomena in Microgravity*

*NASA / Kentucky EPSCoR*

*07/01/99 – 06/30/00. (\$81,352)*

*Principal Investigator: K. A. Tagavi*

*Co-Principal Investigator(s): C. Cremers, J. Jacob, J. McDonough, K. Saito, T. Wu  
R. Hopkins (E. Kentucky Univ.)*

*Phase Change and Transport Phenomena in Microgravity*

*NASA / Kentucky EPSCoR*

*07/01/97 – 06/30/99. (\$210,000)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Numerical Simulation of Fluid Flow and Heat Transfer in a Gas-Log Fireplace*

*Monessen Hearth, Inc.*

*06/15/98 – 09/15/98. (\$3,600 gift to Dept. of Mech. Engr.)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): K. Saito*

*Cooled Turbine Airfoil Trailing Edge Conceptual Study*

*Pratt & Whitney*

*08/01/95 – 09/30/96. (\$14,000)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Advanced Turbulence Models for Heat Transfer in Air Circuits of Gas Turbine Blades*

*NASA/EPSCoR*

*06/01/95 – 05/31/96. (\$20,707)*

*Principal Investigator: M. P. Mengüç*

*Co-Principal Investigator(s): J. M. McDonough*

*Radiation – Turbulence Interaction in Pulverized Coal Flames*

*U. S. Department of Energy*

*10/01/93 – 09/30/96. (\$200,000)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Compressible Flow Turbulence Simulation and Modeling Via Additive Turbulent Decomposition*

*U. S. Air Force Office of Scientific Research / DoD EPSCoR*

*09/01/92 – 08/31/95. (\$128,076)*

*Principal Investigator: S. D. Gedney*

*Co-Principal Investigator(s): G. Fairweather, R. Finkel, J. M. McDonough, T. Tsang*

*Enhancing High Performance Computing at the University of Kentucky*

*National Science Foundation*

*07/01/92 – 06/31/93. (\$93,975)*

*Principal Investigator: R. A. Finkel*

*Co-Principal Investigator(s): X. Cai, T. Draper, G. Fairweather, R. Lodder, J. McDonough,  
Morrison (U of L), Phillips (U of L), T. Tsang, R. Yavatkar*

*Applications of Massively Parallel Computers*

*National Science Foundation / Kentucky EPSCoR*

*01/01/92 – 12/31/94. (\$1,479,182)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Additive Turbulent Decomposition of the Incompressible and Compressible Navier-Stokes  
Equations*

*U. S. Air Force Office of Scientific Research*

*11/01/91 – 10/31/93. (\$95,834)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*Feasibility Study of IRIM Image/Airflow Correlation*

*General Electric Aircraft Engines, Cincinnati, OH*

*08/01/91 – 07/31/92. (\$36,570)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*

*MDSSC-UK Jet Interaction Cooperative Computer Code Development – 1990*

*McDonnell Douglas Space Systems Company, Huntington Beach, CA*

*08/01/90 – 12/31/90. (\$10,000)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): None*  
*Feasibility Study of IRIM Image/Airflow Correlation*  
*General Electric Aircraft Engines, Cincinnati, OH*  
*07/01/90 – 12/31/90. (\$32,099)*

*Principal Investigator: J. M. McDonough*  
*Co-Principal Investigator(s): None*  
*An Additive Turbulent Decomposition of the Navier-Stokes Equations Implemented on Highly-Parallel Computer Systems*  
*U. S. Air Force Office of Scientific Research*  
*06/01/90 – 05/31/91. (\$120,433)*

*Principal Investigator: J. M. McDonough*  
*Co-Principal Investigator(s): Ivan Catton*  
*Jet Interaction Cooperative Study 1989*  
*McDonnell Douglas Astronautics Company, Huntington Beach, CA*  
*07/01/89 – 12/31/89. (\$30,000)*

*Principal Investigator: J. M. McDonough*  
*Co-Principal Investigator(s): Ivan Catton and Tony F. C. Chan*  
*An Additive Turbulent Decomposition of the Navier-Stokes Equations Implemented on Highly-Parallel Computer Systems*  
*U. S. Air Force Office of Scientific Research*  
*04/01/89 – 12/31/89. (\$116,212)*

*Principal Investigator: Ivan Catton*  
*Co-Principal Investigator(s): J. M. McDonough*  
*Jet Interaction Cooperative Study 1988*  
*McDonnell Douglas Astronautics Company, Huntington Beach, CA*  
*09/01/88 – 12/31/88. (\$15,000)*

## Pending

*Principal Investigator: J. M. McDonough*  
*Co-Principal Investigator(s): A. V. Smirnov (West Virginia University)*  
*Simulation of Chaotic Vortices in Flapping-Winged Insect Flight*  
*National Science Foundation*  
*10/01/06 – 09/30/09. (\$533,714)*

## PUBLICATIONS

### Refereed Papers Published in Professional and Scholarly Journals

- L.-S. Yao, Ivan Catton and J. M. McDonough, "Free-Forced Convection from a Heated Longitudinal Cylinder," *Numer. Heat Transfer* **1**, 255, 1978.
- L.-S. Yao, Ivan Catton and J. M. McDonough, "Heat Transfer and Shear Stress on a Heated Cone," *J. Appl. Mech.* **45**, 952, 1978.
- A. Majda, J. M. McDonough and S. Osher, "The Fourier Method for Non-Smooth Initial Data," *Math. Comp.* **32**, 1041, 1978.
- J. M. McDonough and I. Catton, "Mean Field Equations of Bénard Convection," *Phys. Fluids* **23**, 1064, 1980.
- L.-S. Yao, Ivan Catton and J. M. McDonough, "Buoyancy-Driven Asymmetric Boundary Layer Along a Heated Cylinder," *J. Fluid Mech.* **98**, 417, 1980.
- L.-S. Yao, Ivan Catton, and J. M. McDonough, "Asymmetric Boundary Layer on a Nonisothermally Heated Cone," *J. Appl. Mech.* **47**, 467, 1980.
- J. M. McDonough and Ivan Catton, "Accuracy of the Mean Field Approximation and the Physical Effect of Prandtl Number in Bénard Convection," *Phys. Fluids* **25**, 1502, 1982.
- J. M. McDonough and Ivan Catton, "A Mixed Finite Difference-Galerkin Procedure for Two-Dimensional Convection in a Square Box," *Int. J. Heat Mass Transfer* **25**, 1137, 1982.
- C. W. Somerton, J. M. McDonough and Ivan Catton "Natural Convection in a Volumetrically Heated Porous Layer," *J. Heat Transfer* **106**, 241, 1984.
- C. K. B. Lee, J. M. McDonough and M. T. Huang, "Dimension Calculations for Low Flow Rate Steam Injection Experiments," *Phys. Fluids* **29**, 2843, 1986.
- J. M. McDonough and R. J. Bywater, "Large-Scale Effects on Local Small-Scale Chaotic Solutions to Burgers' Equation," *AIAA J.* **24**, 1924, 1986.
- S. D. Heister, J. M. McDonough, A. R. Karagozian and D. W. Jenkins, "The Compressible Vortex Pair," *J. Fluid Mech.* **220**, 339, 1990.
- J. M. McDonough and K. Saito, "Local, Small-Scale Interaction of Turbulence with Chemical Reactions in  $H_2-O_2$  Combustion," *Int. J. Fire Sci. Tech.* **14**, 1, 1994.
- C. K. B. Lee and J. M. McDonough, "Implementation of a Nonlinear Filter with a Lagrangian Formulation for the Treatment of Very High Pressure Reflected Shocks," *J. Comput. Phys.* **117**, 289, 1995.
- J. M. McDonough, "On Intrinsic Errors in Turbulence Models Based on Reynolds-Averaged Navier-Stokes Equations," *Int. J. Fluid Mech. Res.* **22**, 27-55, 1995.
- C. K. B. Lee, R. C. Crawford and J. M. McDonough, "Improved Solutions to the Small Strain Continuum Equations Using a Modified Engquist Filter," *J. Comput. Phys.* **123**, 119, 1996.
- A. J. Salazar, J. M. McDonough and K. Saito, "Computational Fluid Dynamics Simulation of Automotive Spray Painting Process," *Comput. Model. Simul. Engineering* **2**, 131, 1997.
- J. D. Chamberlain and J. M. McDonough, "Resolution Effects in Chaotic Velocity Field Reconstruction from Passive Scalar Data," *AIAA J.* **35**, 1241-1243, 1997.
- E. C. Hylin and J. M. McDonough, "Derivation of Projection Methods from Integration of the Navier-Stokes Equations," *J. Comput. Appl. Math.* **81**, 349-374, 1997.
- J. M. McDonough, S. Mukerji and S. Chung, "A Data-Fitting Procedure for Chaotic Time Series," *Appl. Comput. Math.* **95**, 219-243, 1998.

S. Mukerji, J. M. McDonough, M. P. Mengüç, S. Manickavasagam and S. Chung, "Chaotic-Map Models of Soot Fluctuations in Turbulent Diffusion Flames," *Int. J. Heat Mass Transfer* **41**, 4095–4112, 1998.

E. J. Brauer, M. Turowski and J. M. McDonough, "Additive Decomposition Applied to the Semiconductor Drift-Diffusion Model," *VLSI Design* **8**, 393–399, 1998.

V. E. Garzon, J. M. McDonough and K. Saito, "Time-Dependent Model of Forest Fire Spread in Turbulent Gusting Cross Winds," *J. Amer. Soc. Testing Mat. STP* **1336**, 73–83, 1998.

E. C. Hylin and J. M. McDonough, "Chaotic Small-Scale Velocity Fields as Prospective Models for Unresolved Turbulence in an Additive Decomposition of the Navier-Stokes Equations," *Int. J. Fluid Mech. Res.* **26**, 164–192, 1999.

E. T. Schmeisser, J. M. McDonough, M. Bond, P. Hislop and A. D. Epstein, "Fractal Analysis of Reading Eye Movements," *Optometry and Vision Science*, **78**, 805–814, 2001.

T. Yang, J. M. McDonough and J. D. Jacob, "Poor man's Navier–Stokes equation model of turbulent flow," *AIAA J.* **41** 1690–1696, 2003.

J. M. McDonough, S. A. Bible and J. Scoville, J., "Response to Strain Rate in a Discrete Dynamical System Model of the High-Wavenumber Navier–Stokes Equation," *J. of Turbulence* **4**, 1–18, 2003. (Electronic journal, <http://jot.iop.org/>)

S. A. Bible and J. M. McDonough, "Basins of attraction for the two-dimensional 'poor man's Navier–Stokes equation'," *Int. J. Bifurcation and Chaos* **14**, 2381–2386, 2004.

Ying Xu, J. M. McDonough, K. A. Tagavi and Dayong Gao, "2-D Phase-Field Model Applied to Freezing into a Supercooled Melt," *Cell Preservation Technology* **2**, 113–124, 2004.

J. M. McDonough and M. T. Huang, "A 'poor man's Navier–Stokes equation': derivation and numerical experiments-the 2-D case," *Int. J. Numer. Meth. Fluids* **44**, 545–578, 2004.

Ying Xu, J. M. McDonough and K. A. Tagavi, "A Numerical Procedure for Solving 2-D Phase-Field Model Problems," *in press, J. Comput. Phys.*, 2006.

J. M. McDonough, I. Kunadian and R. R. Kumar, "An Alternative Discretization and Solution Procedure for the Dual Phase-Lag Equation," *in press, J. Comput. Phys.*, 2006.

### Journal Papers Currently Being Reviewed

T. Yang and J. M. McDonough, "Exact solution to Burgers' equation exhibiting erratic turbulent-like behavior," *submitted to Computers and Fluids*, 2004.

A. N. Ziaei, J. M. McDonough, H. Emdad and A. R. Keshavarzi, "Using vorticity to define conditions at multiple open boundaries for simulating flow in a simplified vortex settling basin," *submitted to Int. J. Numer. Meth. Fluids*, 2006.

### Refereed (no less than reviewed abstract) Conference and Symposium Papers

L.-S. Yao, Ivan Catton and J. M. McDonough, "The Longitudinal Water Boundary Layer Along a Nonisothermally Heated Horizontal Cylinder," *ASME Paper 78-HT-19*, presented at *AIAA/ASME Thermophysics and Heat Transfer Conf.*, Palo Alto, CA, May 24–26, 1978.

J. M. McDonough and Ivan Catton, "Wavenumber Selection Via Thermodynamic Stability for Two-Dimensional Bénard Convection," *ASME Paper 79-WA/HT-14*, presented at *ASME Winter Annual Meeting*, New York, Dec. 2–7, 1979.

J. M. McDonough and Ivan Catton, "A Physical Mechanism for the Increase of Cell Wavelength in Rayleigh-Bénard Convection," *ASME Paper 80-HT-75*, presented at *Joint ASME/AIChE National Heat Transfer Conf.*, Orlando, FL, July 27–30, 1980.

- J. M. McDonough, and Ivan Catton, "A Mixed Finite Difference-Galerkin Procedure for Two-Dimensional Convection in a Square Box," ASME Paper 80-HT-88, presented at Joint ASME/AIChE National Heat Transfer Conf., Orlando, FL, July 27–30, 1980.*
- J. M. McDonough, and Ivan Catton, "An Initial Value Problem for Wavenumber Selection in Steady Two-Dimensional Bénard Convection," ASME Paper 82-WA/HT-65, presented at ASME Winter Annual Meeting, Phoenix, AZ, Nov. 16–19, 1982.*
- J. M. McDonough, R. J. Bywater and J. C. Buell, "An Investigation of Strange Attractor Theory and Small Scale Turbulence," AIAA Paper 84-1674, presented at AIAA 17th Fluid Dynamics, Plasmadynamics and Lasers Conf., Snowmass, CO, June 24–28, 1984.*
- J. M. McDonough, J. C. Buell and R. J. Bywater, "A Comparison of Routes to a Strange Attractor in One-Dimensional Local Models of Turbulent Free and Forced Convection," ASME Paper 84-WA/HT-16, presented at ASME Winter Annual Meeting, New Orleans, LA, Dec. 9–14, 1984.*
- J. M. McDonough and R. J. Bywater, "Effects of Local Large-Scale Parameters on the Small-Scale Chaotic Solutions to Burgers' Equation," AIAA Paper 85-1653, presented at AIAA 18th Fluid Dynamics, Plasmadynamics and Lasers Conf., Cincinnati, OH, July 16–18, 1985.*
- J. M. McDonough, "A Class of Model Problems for Testing Navier-Stokes Solvers," AIAA Paper 88-3646, presented at the First National Fluid Dynamics Congress, Cincinnati, OH, July 24–28, 1988.*
- J. M. McDonough and R. J. Bywater, "Turbulent Solutions from an Unaveraged, Additive Decomposition of Burgers' Equation," presented at the ASME Fluids Engineering Conference, San Diego, CA, July 9–12, 1989.*
- J. M. McDonough, M. T. Huang and R. J. Bywater, "The Lorenz Model of Aperiodic Toroidal Thermosyphon Flow: Comparison of Theory and Experiment," presented at the ASME Fluids Engineering Conference, San Diego, CA, July 9–12, 1989.*
- J. M. McDonough and Ivan Catton, "Calculation of a Lateral Jet in a Hypersonic Cross-Flow," AIAA Paper 89-2549, presented at AIAA/ASME/SAE/ASEE 25<sup>th</sup> Joint Propulsion Conference, Monterey, CA, July 10–12, 1989.*
- J. M. McDonough, D. C. Weatherly, Ivan Catton and D. W. Harvey, "Further Studies of Supersonic Jet Interaction with a Hypersonic Crossflow," AIAA Paper 90-2101, presented at AIAA/SAE/ASME/ASEE 26<sup>th</sup> Joint Propulsion Conference, Orlando, FL, July 16–18, 1990.*
- S. S. Chen, A. S. Lavine and J. M. McDonough, "Computation of Three-Dimensional Opposing Mixed Convection between Inclined Heated Plates," presented at 9<sup>th</sup> International Heat Transfer Conference, Jerusalem, Israel, Aug. 19–24, 1990.*
- D. C. Weatherly and J. M. McDonough, "Performance Comparisons of Navier-Stokes Codes for Simulating Three-Dimensional Hypersonic Crossflow/Jet Interaction," AIAA Paper 91-2096, presented at AIAA/ASME/SAE 27<sup>th</sup> Joint Propulsion Conference, Sacramento, CA, June 24–27, 1991.*
- J. M. McDonough and K. Saito, "Local, Small-Scale Interaction of Turbulence with Chemical Reactions in  $H_2-O_2$  Combustion," presented at 13<sup>th</sup> International Symposium on the Dynamics of Explosions and Reactive Systems, Nagoya, Japan, 28 July–2 August, 1991.*
- E. C. Hylin and J. M. McDonough, "Additive Turbulent Decomposition Applied to an Isolated Vortex in a Constant Shear Flow," presented at 4<sup>th</sup> International Symposium on Computational Fluid Dynamics, Davis, CA, Sept. 9–12, 1991.*
- L. Xiang, J. M. McDonough and K. Saito, "Numerical Simulation of Flow and Temperature Field Induced by Coflow Laminar Diffusion Flame," presented at First Asian Conference on Fire Science and Technology, The University of Science and Technology of China, Hefei, Anhui, P. R. China, October 8–12, 1992.*

Y. Yang and J. M. McDonough, "Bifurcation Studies of Navier-Stokes Equations via Additive Turbulent Decomposition," presented at ASME Winter Annual Meeting, Anaheim, CA, Nov. 8–13, 1992.

J. M. McDonough and D. Wang, "Additive Turbulent Decomposition: A Highly Parallelizable Turbulence Simulation Technique," presented at Parallel CFD '93, Paris, France, May 10–12, 1993.

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- J. M. McDonough and M. T. Huang, "Discrete dynamical systems subgrid-scale models for LES of turbulent combustion," *Bull. Amer. Phys. Soc.* **45**, 121, 2000.
- S. A. Bible and J. M. McDonough, "Basins of attraction for a discrete dynamical system derived from the 3-D Navier-Stokes equations," *Bull. Amer. Phys. Soc.* **46**, 206, 2001.
- J. M. McDonough and D L. Joyce, "A low-dimensional discrete dynamical system model of small scales of thermal convection," *Bull. Amer. Phys. Soc.* **46**, 206, 2001.
- T. Yang, J. M. McDonough and J. D. Jacob, "Poor man's Navier-Stokes equation model of velocity components in the backward-facing step and turbulator flow," *Bull. Amer. Phys. Soc.* **46**, 162, 2001.
- S. A. Bible and J. M. McDonough, "Numerical investigation of a 3-D discrete dynamical system derived from the Navier-Stokes equations," *Dayton-Cincinnati AIAA Aerospace Science Symposium, Dayton, OH, March 5, 2002.*
- D. L. Joyce and J. M. McDonough, "A Discrete Dynamical System Subgrid-Scale Model of Turbulent Convection," *Dayton-Cincinnati AIAA Aerospace Science Symposium, Dayton, OH, March 5, 2002.*
- J. M. McDonough and Sha Zhang, "Analysis and modeling of a turbulent hydrogen-air jet flame experiment," *Bull. Amer. Phys. Soc.* **47**, 191, 2002.
- J. D. Slade, Sha Zhang and J. M. McDonough, "A Low-Order Discrete Dynamical System Model of Turbulent Fluctuations in a Reduced Mechanism for  $H_2 - O_2$  Combustion," *Dayton-Cincinnati AIAA Aerospace Science Symposium, Dayton, OH, March 5, 2002.*

Ying Xu, T. Yang, J. M. McDonough and K. A. Tagavi, "A Discrete-Operator Interpolation Solution of the Phase-Field Model," *Dayton-Cincinnati AIAA Aerospace Science Symposium*, Dayton, OH, March 5, 2002.

T. Yang, J. M. McDonough and J. D. Jacob, "Numerical simulation of turbulence based on a synthetic velocity subgrid-scale model," *Bull. Amer. Phys. Soc.* **47**, 29, 2002.

Sha Zhang and J. M. McDonough, "LES Subgrid-Scale Models of Turbulence-Chemical Kinetics Interactions Based on Discrete Dynamical Systems," *Dayton-Cincinnati AIAA Aerospace Science Symposium*, Dayton, OH, March 5, 2002.

J. C. Holloway and J. M. McDonough, "An Alternative Approach to Large-Eddy Simulation Subgrid-Scale Modeling for Turbulent Convection," *28<sup>th</sup> Annual Dayton-Cincinnati AIAA Aerospace Science Symposium*, Dayton, OH, March, 2003. (Received a "Best Student Presentation" Award.)

Andrew Loh, Jeremy D. Slade and J. M. McDonough, "Simulation of Vorticity-Buoyancy Interactions in Fire-Whirl-Like Phenomena," *28<sup>th</sup> Annual Dayton-Cincinnati AIAA Aerospace Science Symposium*, Dayton, OH, March, 2003.

J. C. Holloway, M. G. Chong and J. M. McDonough, "Analysis of a discrete dynamical system modeling thermal convection," *Bulletin of the American Physical Society* **48**, 211, 2003.

Y. Xu, J. M. McDonough and K. A. Tagavi, "Numerical simulation of 2-D phase-field model with convection," *Bulletin of the American Physical Society* **48**, 231, 2003.

T. Yang, J. M. McDonough and J. D. Jacob, "LES of 3-D duct flow based on a synthetic velocity subgrid-scale model," *Bulletin of the American Physical Society* **48**, 120, 2003.

J. M. McDonough and T. Yang, "LES of an internally heated, swirling buoyant plume," *Bulletin of the American Physical Society* **48**, 196, 2003.

S. Bible, J. M. McDonough and T. Yang, "Large-eddy simulation of 2-D channel flow," *Bulletin of the American Physical Society* **48**, 120, 2003.

M. G. Chong, J. C. Holloway and J. M. McDonough, "Analysis of discrete dynamical system modeling thermal convection," *29<sup>th</sup> Annual Dayton-Cincinnati AIAA Aerospace Science Symposium*, Dayton, OH, March 2, 2004.

Illaythambi Kunadian, J. M. McDonough and K. A. Tagavi, "Numerical simulation of heat transfer mechanisms during femtosecond laser heating of nano-films using 3-D dual phase lag model," *29<sup>th</sup> Annual Dayton-Cincinnati AIAA Aerospace Science Symposium*, Dayton, OH, March 2, 2004.

J. M. McDonough, J. C. Holloway and M. G. Chong, "Temporal behavior of a low-dimensional dynamical system proposed for construction of subgrid-scale models in LES of scalar transport," *Bulletin of the American Physical Society* **49**, 96, 2004.

Brett G. Compton and J. M. McDonough, "Quasi-Steady Simulation of Insect-Like Flapping Wing," *Bulletin of the American Physical Society* **50**, 58, 2005.

J. M. McDonough, "Analysis of 'Poor Man's Navier-Stokes' and Thermal Energy Equation for High-Rayleigh Number Turbulent Convection," *Bulletin of the American Physical Society* **50**, 147, 2005.

Ying Xu, J. M. McDonough and K. A. Tagavi, "Numerical Simulations of Solidification in a Convecting Supercooled Melt," *Bulletin of the American Physical Society* **50**, 214, 2005.

C. B. Velkur and J. M. McDonough, "A Compressible 'Poor Man's Navier-Stokes' Equation Discrete Dynamical System," *Bulletin of the American Physical Society* **50**, 236, 2005.

#### Invited Talks and Workshop Presentations

J. M. McDonough, "Investigation of Chemical Kinetics/Small-Scale Turbulence Interactions Via Additive Turbulent Decomposition," presented at *Workshop on Advances in Computational Methods*

for Transport Phenomena, University of Kentucky, Lexington, KY, Jan. 7–9, 1991.

J. M. McDonough, “Effects of Reynolds Averaging Applied to Quasilinear Parabolic PDEs,” presented at University of Kentucky Mathematics Seminar, Lexington, KY, April 25, 1991.

J. M. McDonough, “Effects of Reynolds Averaging Applied to Quasilinear Parabolic PDEs,” presented at NIST, Gaithersburg, MD, July 2, 1991.

J. M. McDonough, “Additive Turbulent Decomposition: A New Direction in Turbulence Simulation – An Overview,” presented at University of Tokyo, Reaction Chemistry Department Seminar, Tokyo, Japan, July 25, 1991.

J. M. McDonough, “The Large-Scale Equations of Additive Turbulent Decomposition as a Model of Chemically Reacting Turbulent Flow,” presented at the XI<sup>th</sup> International Workshop on Mathematical Methods in Combustion, Tsukuba, Japan, July 26–27, 1991.

J. M. McDonough, “STRANGE ATTRACTORS – What Are They, Where Are They, Are They Important?” Center for Computational Sciences Seminar, University of Kentucky, Sept. 25, 1991.

J. M. McDonough, “Application of Chaos Theory in Ophthalmology: An Introduction,” presented at Department of Ophthalmology, University of Kentucky, Nov. 5, 1991.

J. M. McDonough, “Unaveraged Turbulence Models Based on the Large-Scale Equations of Additive Turbulent Decomposition,” presented at University of Southern California Aerospace Engineering Seminar, Los Angeles, CA, Mar. 23, 1992.

J. M. McDonough, “CFD at the University of Kentucky,” presented at Wright Laboratories, WPAFB, Dayton, OH, June 15, 1993.

J. M. McDonough, “CFD at the University of Kentucky,” presented at NASA Lewis Research Center, Internal Fluid Mechanics Division, Cleveland, OH, Aug. 6, 1993.

J. M. McDonough, “The Additive Turbulent Decomposition Formalism: An Alternative Approach to Turbulence Modeling and Simulation,” Presented at Hong Kong University of Science and Technology, Mechanical Engineering Department Seminar, Clear Water Bay, Hong Kong, May 24, 1994.

J. M. McDonough, “Additive Turbulent Decomposition of the Navier-Stokes Equations: An Alternative Formalism for Turbulence Modeling,” presented at UCLA Mechanical, Aerospace & Nuclear Engineering Department Seminar, Mar. 23, 1995.

J. M. McDonough, “Turbulence Computations Based on Unaveraged Equations and Nonlinear Chaotic Map Subgrid-Scale Models,” presented at NASA Lewis Research Center, Heat Transfer Branch, Aug. 22, 1995.

J. M. McDonough, “Turbulence – Past, Present, ..., Future?” presented at University of Kentucky Center for Computational Sciences Seminar, Oct. 4, 1995.

J. M. McDonough, “Small-Scale Turbulence Modeling and Simulation Via Additive Decompositions of the Navier-Stokes Equations,” presented at the Institute for Mathematics and Its Applications, University of Minnesota, Minneapolis, MN, Oct. 26, 1995.

J. M. McDonough, “Turbulence Models Based on Unaveraged Additively-Decomposed Navier-Stokes Equations and Nonlinear, Chaotic Algebraic Maps,” presented at University of California, Irvine Mechanical and Aerospace Engineering Department Seminar, Mar. 13, 1996.

J. M. McDonough, “Turbulence Modeling/Simulation Formalisms Based on Additive Decompositions of Governing Equations,” presented at Université Pierre et Marie Curie (Paris VI), Modélisation en Mécanique Seminar, Paris, France, May 13, 1996.

J. M. McDonough, “Turbulence Modeling/Simulation Formalisms Based on Additive Decompositions of Governing Equations,” presented at Centre d’Etudes Nucléaires de Grenoble, Département de Thermohydraulique et de Physique Seminar, Grenoble, France, May 15, 1996.

- J. M. McDonough, “Renormalization Group Techniques in Fluid Dynamics,” presented at University of Kentucky Department of Physics and Astronomy Seminar, April 21, 1997.*
- J. M. McDonough, “Turbulence Modeling Past, Present, . . . , Future,” presented at Second International Symposium on Scale Modeling, Lexington, KY, June 23-27, 1997.*
- J. M. McDonough, “Mathematics in Industry — Perceptions, Applications, Potential,” presented at the First University of Kentucky Workshop on Industrial Mathematics, Sept. 26–27, 1997.*
- J. M. McDonough, “The Future of Computing in Fluid Dynamics,” Center for Computational Sciences 10<sup>th</sup> Anniversary Seminar, University of Kentucky, Oct. 1, 1997.*
- J. M. McDonough, “Turbulence Modeling Past, Present, . . . , Future,” presented at Mechanical Engineering Seminar, Michigan State University, East Lansing, MI, Oct. 30, 1997.*
- J. M. McDonough, “Computational Fluid Dynamics at the University of Kentucky,” presented at Pacific Sierra Research Corp., Santa Monica, CA, Mar. 17, 1998.*
- M. Pinar Mengüç and James M. McDonough, “Chaotic Radiation/Turbulence Interactions in Flames,” keynote lecture presented at Eurotherm Seminar #56, Delphi, Greece, April 3, 1998.*
- J. M. McDonough, “Turbulence Modeling and Simulation Via Additive Turbulent Decomposition of the Navier-Stokes Equations: Theory, Implementation, Results,” presented at General Electric Corporate Research and Development Center, Schenectady, NY, April 28, 1998.*
- J. M. McDonough, “Computational Fluid Dynamics at the University of Kentucky,” presented at National Kaohsiung Institute of Technology, Department of Mechanical Engineering, Kaohsiung, Taiwan (ROC), May 15, 1998.*
- J. M. McDonough, “Discrete Dynamical Systems as Subgrid-Scale Turbulence Models,” presented at Nagoya University, Department of Mechanical Engineering, Nagoya, Japan, May 19, 1998.*
- J. M. McDonough, “Simulation of Large-Scale Fires, a Wildland Fire Example,” presented at University of Tokyo, Department of Chemical Systems Engineering, Tokyo, Japan, May 20, 1998.*
- J. D. Jacob and J. M. McDonough, “Fluid Mechanics at the University of Kentucky,” presented at General Electric Aircraft Engines, Cincinnati, OH, Oct. 1, 1998.*
- J. M. McDonough, “Additive Turbulent Decomposition of the Navier-Stokes Equations: Structure and Mathematical Questions,” to be presented at the Mini-Symposium on Mathematics of the Navier-Stokes Equations, American Mathematical Society Meeting, San Antonio, TX, Jan. 13–16, 1999.*
- J. M. McDonough, “WHAT GOOD IS CHAOS? Is This a Solution Looking for a Problem?” presented at Brooks Air Force Base, San Antonio, TX, Jan. 14, 1999.*
- J. M. McDonough, “Large-Eddy Simulation of Turbulence-Chemical Kinetics Interactions Using Discrete Dynamical Systems as Subgrid-Scale Models,” presented at University of Hiroshima, Department of Mechanical Engineering Seminar, September 19, 2000.*
- J. M. McDonough, “A Poor Man’s Navier–Stokes Equation, Its Application to ‘Synthetic Velocity’ Subgrid-Scale Models for Large-Eddy Simulation of Turbulence,” presented at it 10<sup>th</sup> Anniversary University of Kentucky Center for Computational Sciences Seminar, September 12, 2001.*
- J. M. McDonough, “A Poor Man’s Navier–Stokes Equation, Its Application to ‘Synthetic Velocity’ Subgrid-Scale Models for Large-Eddy Simulation of Turbulence,” presented at it Worcester Polytechnic Institute Mechanical Engineering Seminar, November 9, 2001.*
- J. M. McDonough, “Fluid Dynamics at UK, Potential for Industrial Applications and Collaborations,” presented at University of Kentucky Seminar on Industrial Collaboration Opportunities, December, 2001.*
- J. M. McDonough, “The Navier–Stokes Equations and Their Approximations as Models of Turbu-*

lence: *Evolution of Ideas, Mathematical Implications and Questions*,” presented at University of Kentucky Department of Mathematics, PDE Seminar, April, 2002.

J. M. McDonough, “A Different Approach to Large-Eddy Simulation with Advantages for Computing Turbulence-Chemical Kinetics Interactions,” presented at University of Hiroshima, Department of Mechanical Engineering Seminar, May 24, 2002.

J. M. McDonough, “An Alternative Approach to Large-Eddy Simulation,” presented to the Combustion Branch, NASA Glenn Research Center, Mar. 15, 2005.

J. M. McDonough, “A Two-Level LES Constructed with Unfiltered Equations and SGS Models of Physical Variables,” presented at Workshop on Fluid Turbulence: Multiscale Interactions in Turbulent Flow, Center for Nonlinear Studies, Los Alamos National Laboratories, Santa Fe, NM, July 18–21, 2005.

## Reports

L. E. Cothran, J. M. McDonough, B. R. Phillips, et al., *UpSTAGE External Burning Technology Report, Vol. II, (Originally Secret Classification, available through Advanced Ballistic Missile Defense Agency, Huntsville, Alabama)*, 1972.

J. Castle, J. M. McDonough, N. C. Ostrander and Ivan Catton, *LMFBR Fuel Analysis Task B: Post-Accident Heat Removal, Final Report 1976-1977, UCLA-ENG-7761*, 1977.

Ivan, Catton, V. K. Dhir, W. A. Brinsfield, J. M. McDonough and N. C. Ostrander, *LMFBR Fuel Analysis Task B: Post-Accident Heat Removal, Final Report 1977-1978, USNRC NUREG/CR-0737*, 1978.

J. M. McDonough, E. D. Ndefo and G. W. Widhopf, “Development of Efficient Numerical Methods for Solution of Internal Flow Problems,” *Final Report, Aerospace Sponsored Research Project ASR-81-9510A, The Aerospace Corporation, El Segundo, CA*, 1981.

J. M. McDonough, E. D. Ndefo and G. W. Widhopf, “Efficient Numerical Methods for Internal Flow Problems,” *Final Report, Aerospace Sponsored Research Project ASR-82-9510, The Aerospace Corporation, El Segundo, CA*, 1982.

J. M. McDonough, R. J. Bywater and J. C. Buell, “Strange Attractor Description of Chaotic Phenomena,” *Final Report, Aerospace Sponsored Research Project ASR-84-8227, The Aerospace Corporation, El Segundo, CA*, 1984.

J. M. McDonough and R. J. Bywater, “Strange Attractor Description of Chaotic Phenomena,” *Final Report, Aerospace Sponsored Research Project ASR-85-8027, The Aerospace Corporation, El Segundo, CA*, 1985.

J. M. McDonough and A. A. Fote, “Strange Attractor Description of Chaotic Phenomena,” *Final Report, Aerospace Sponsored Research Project ASR-86-8127, The Aerospace Corporation, El Segundo, CA*, 1986.

J. M. McDonough, E. C. Hylin, Ivan Catton, Tony F.-C. Chan and T. Mathew, “An Additive Turbulent Decomposition of the Navier-Stokes Equations Implemented on Highly Parallel Computer Systems,” *Annual Report, Air Force Office of Scientific Research Grant 89-0281*, 1989.

J. M. McDonough, E. C. Hylin, Ivan Catton, Tony F.-C. Chan and T. Mathew, “An Additive Turbulent Decomposition of the Navier-Stokes Equations Implemented on Highly Parallel Computer Systems,” *Final Report, Air Force Office of Scientific Research Grant 89-0281 (also published as UCLA-ENG-6762N-87)*, 1990.

J. M. McDonough, E. C. Hylin, Tony F.-C. Chan and T. Mathew, “An Additive Turbulent Decomposition of the Navier-Stokes Equations Implemented on Highly Parallel Computer Systems,” *Annual Report, Air Force Office of Scientific Research Grant 90-0271*, 1990.

J. M. McDonough, E. C. Hylin, Y. Yang, X. Zhong, Tony F.-C. Chan and T. Mathew, “An Additive

*Turbulent Decomposition of the Navier-Stokes Equations Implemented on Highly Parallel Computer Systems,” Final Report, Air Force Office of Scientific Research Grant 90-0271, 1991.*

*A. J. Salazar and J. M. McDonough, “Flow in a Pipe with Holes at the Surface,” Mechanical Engineering Report No. CFD-01-91, University of Kentucky, January, 1991.*

*J. M. McDonough, A. J. Salazar, L. Wang and D. C. Weatherly, “Feasibility Study of IRIM Image/Airflow Correlation, Final Report,” General Electric Aircraft Engine Company Contract K923110, 1991.*

*J. M. McDonough and K. Saito, “Local, Small-Scale Interaction of Turbulence with Chemical Reactions in H<sub>2</sub>-O<sub>2</sub> Combustion,” Mechanical Engineering Report No. CFD-02-91, University of Kentucky, August, 1991.*

*Y. Yang and J. M. McDonough, “Bifurcation Studies of the Navier-Stokes Equations Via Additive Turbulent Decomposition,” Mechanical Engineering Report No. CFD-01-92, University of Kentucky, July, 1992.*

*L. Xiang, J. M. McDonough and K. Saito, “Numerical Simulation of Flow and Temperature Field Induced by Coflow Laminar Diffusion Flames,” Mechanical Engineering Report No. CFD-02-92, University of Kentucky, August, 1992.*

*J. M. McDonough, Y. Yang and X. Zhong, “Additive Turbulent Decomposition of the Incompressible and Compressible Navier-Stokes Equations,” Mechanical Engineering Report No. CFD-03-92, University of Kentucky, December, 1992.*

*Y. Chen, C. J. Cremers and J. M. McDonough, “3dwelder: A Transient Three-Dimensional Model for Arc-Welding Processes,” Mechanical Engineering Report No. CFD-01-93, University of Kentucky, March, 1993.*

*J. M. McDonough, “On the Effects of Modeling Errors in Turbulence Closures for the Reynolds-Averaged Navier-Stokes Equations,” Mechanical Engineering Report No. CFD-03-93, University of Kentucky, August, 1993.*

*E. C. Hylin and J. M. McDonough, “Chaotic-Map Models for the Small-Scale Quantities in an Additive Decomposition of the Navier-Stokes Equations,” Mechanical Engineering Report No. CFD-01-94, University of Kentucky, April, 1994.*

*J. M. McDonough and D. Wang, “Additive Turbulent Decomposition: A Highly Parallelizable Turbulence Simulation Technique,” Mechanical Engineering Report No. CFD-02-94, University of Kentucky, August, 1994.*

*J. M. McDonough, Y. Yang and E. C. Hylin, “Modeling Time-Dependent Turbulent Flow over a Backward-Facing Step Via Additive Turbulent Decomposition and Chaotic Algebraic Maps,” Mechanical Engineering Report No. CFD-03-94, University of Kentucky, September, 1994.*

*M. P. Mengüç, J. M. McDonough, S. Manickavasagam, S. Ghosal, D. Wang and S. Mukerji, “Radiation/Turbulence Interactions in Pulverized-Coal Flames,” First-Year Progress Report, submitted to Department of Energy, Pittsburgh Energy Technology Center, Pittsburgh, PA, Sept. 1994.*

*Y. Chen, J. M. McDonough and C. J. Cremers, “Thermocapillary Flow with Two Free Surfaces,” Mechanical Engineering Report No. CFD-01-95, University of Kentucky, January, 1995.*

*E. C. Hylin and J. M. McDonough, “Derivation of Projection Methods from Integration of the Navier-Stokes Equations,” Mechanical Engineering Report No. CFD-02-95, University of Kentucky, May, 1995.*

*D. C. Weatherly and J. M. McDonough, “Computed Large-Scale Compressible Boundary Layer Structure Stimulated by Vortical Perturbations,” Mechanical Engineering Report No. CFD-03-95, University of Kentucky, May, 1995.*

*J. M. McDonough, C. Qian, M. Daikoku and K. Saito, “Flow and Temperature Structures Induced*

by Corner Wall Fires,” *Mechanical Engineering Report No. CFD-04-95*, University of Kentucky, July, 1995.

M. P. Mengüç, J. M. McDonough, S. Manickavasagam, S. Mukerji, D. Wang, S. Ghosal and S. Swabb, “Radiation/Turbulence Interactions in Pulverized-Coal Flames,” *Second-Year Progress Report*, submitted to Department of Energy, Pittsburgh Energy Technology Center, Pittsburgh, PA, Sept. 1995.

J. M. McDonough, C. Qian and K. Saito, “Cooled Turbine Airfoil Trailing Edge Conceptual Study,” *Final Report* submitted to Pratt & Whitney Division of United Technologies, West Palm Beach, FL, Oct. 1995.

A. J. Salazar, J. M. McDonough and K. Saito, “Computational Fluid Dynamics Simulation of Automotive Spray Painting Process,” *Mechanical Engineering Report No. CFD-01-96*, University of Kentucky, October, 1996.

M. P. Mengüç, J. M. McDonough, S. Manickavasagam, S. Mukerji, and S. Swabb, “Radiation/Turbulence Interactions in Pulverized-Coal Flames,” *Third-Year Progress Report*, submitted to Department of Energy, Pittsburgh Energy Technology Center, Pittsburgh, PA, Sept. 1996.

E. C. Hylin and J. M. McDonough, “Theoretical Development of a Stochastic Model for Small-Scale Turbulence in an Additive Decomposition of the Navier-Stokes Equations,” *Mechanical Engineering Report No. CFD-02-96*, University of Kentucky, November, 1996.

J. M. McDonough and M. T. Huang, “A ‘poor man’s Navier–Stokes equation’: derivation and numerical experiments—the 2-D case,” *Mechanical Engineering Report No. CFD-03-01*, University of Kentucky, May, 2001.

## OTHER PROFESSIONAL ACTIVITIES

### Consulting

*Consultant in computational fluid dynamics for Logicon/RDA, Los Angeles, CA, a division of Northrup-Grumman, 1995–2000.*

*Textbook reviewer, McGraw-Hill: 1994–pres.*

### Short Courses Taught

*Instructor for CFD Short Course, offered annually by UCLA Extension, 1988–1992.*

*Instructor for UCLA Extension course in undergraduate numerical analysis, 1982–1987.*

*Instructor for National Technical University (NTU) short course on basic computational numerical analysis, February 1993.*

### Session Chairmanships, etc.

*Session Chair, AIAA 22<sup>nd</sup> Fluid Dynamics, Plasmadynamics and Lasers Conference, Honolulu, Hawaii, June 24–27, 1991.*

*Session Chair, First Asian Conference on Fire Science and Technology, the University of Science and Technology of China, Hefei, Anhui, P. R. China, October 8–10, 1992.*

*Session Chair, American Physical Society 47<sup>th</sup> Division of Fluid Dynamics Meeting, Atlanta, GA, Nov. 20–22, 1994.*

*Attendee, AFOSR/OSU Workshop on Turbulence Structure and Control, Columbus, OH, April 1–3, 1991.*

*Attendee, AFOSR/ONR Workshop on Turbulence Structure and Control, Chicago, IL, May 4–6, 1992.*

*Member, NASA Review Panel for Proposals on Microgravity Research, Washington, DC, Nov. 9–10, 1995.*

*Attendee, AFOSR Contractors Meeting, Atlanta, GA, Sep. 3–4, 1996.*

*Member, Organizing Committee, Second International Symposium on Scale Modeling, held in Lexington, KY, June 23–27, 1997.*

*Attendee, AFOSR Contractors and Grantees Meeting, Hampton, VA, Aug. 13–15, 1997.*

*Member of Organizing Committee and Session Chair, 10<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Hsinchu, Taiwan (ROC), May 11–14, 1998.*

*Attendee, AFOSR Contractors and Grantees Meeting, Annapolis, MD, Aug. 18–20, 1998.*

*Member of Organizing Committee and Session Chair, 11<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Williamsburg, VA, May 23–26, 1999.*

*Member of Organizing Committee and Session Chair, 12<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Trondheim, Norway, May 22–25, 2000.*

*Member of Organizing Committee and Session Chair, 13<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Egmond aan Zee, The Netherlands, May 21–23, 2001.*

*Attendee, AFOSR Contractors Meeting in Turbulence and Rotating Flows, Seattle, WA, Aug. 13–14, 2001.*

*Member of Organizing Committee and Session Chair, 14<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Kansai City, Japan, May 20–22, 2002.*

*Member of Organizing Committee and Session Chair, 15<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Moscow, Russia, May 13–15, 2003.*

*Attendee, DARPA Force Application and Launch from CONUS, Industry Day, Alexandria, VA, July 8, 2003.*

*Member of Organizing Committee and Session Chair, 16<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, Gran Canaria, Canary Islands, Spain, May 24–27, 2004.*

*Member of Organizing Committee and Session Chair, 17<sup>th</sup> Annual Conference on Parallel Computational Fluid Dynamics, University of Maryland, College Park, MD, May 23–26, 2004.*

## UNIVERSITY SERVICE

### Campus-Wide

*Member of Center for Computational Sciences Program Allocation Committee (PAC), 1990–1996, J. W. D. Connolly, Chair.*

*Member of organizing committee for NSF sponsored workshop, “Advances in Computational Methods for Transport Phenomena,” University of Kentucky, Jan. 7–9, 1991.*

*Member of Review Committee for Major Research Equipment Competition proposals, 1991–92.*

*Member of University Computing Advisory Committee, Research Computing Subcommittee, 1991–1994, G. Fairweather, Chair.*

*Member of Engineering Workstation Laboratory Committee, 1993–1996, K. B. Hamperian, Chair.*

*Member of Mathematical Sciences Colloquium Committee, 1993–1998, P. Perry, Chair.*

*Member of ad hoc committee for classroom renovation to facilitate multi-media instruction, 1996, R. S. Tannenbaum, Chair.*

*Member of Review Committee for Research Committee Grant Program proposals, 1996–97.*

*Member of the Graduate Council, 1999–2000.*

*Member of Research Computational Resources Taskforce, 2003–2004, B. Kucera, Chair.*

*Member of Computer Security & Resource Allocation Advisory Committee, 2003–2004, R. S. Tannenbaum, Chair.*

*Member of Academic Area Advisory Committee for the Physical and Engineering Sciences, 2003–2005.*

### College

*Chair of ad hoc committee for establishing undergraduate engineering workstation laboratory, 1992–1993.*

*Member of ad hoc committee for classroom renovation to facilitate multi-media instruction, 1993.*

*Member of liaison committee for moving Department of Computer Science from College of Arts and Sciences to College of Engineering, 1993–1994.*

*Member of planning committee for Engineers Week, 1997–pres.*

### Departmental

*Designed and supervised construction of new Graduate Studies recruitment poster, 1990.*

*Member of Graduate Studies Committee, 1990–1996, 2005–pres.*

*Chair of Activities Committee, 1991–1996 (Coordinated ME Dept. 1991–1996 Engineers Week activities)*

*Organizer of Department CFD Seminar series (each semester, 1991–1998) in conjunction with Center for Computational Sciences.*

*Wrote script for, and supervised filming and editing of, ME Department undergraduate recruitment video, 1992.*

*Member of Seminar Committee, 1992–1996.*

*Developed new undergraduate course in computational fluid dynamics first taught Spring Semester, 1994.*

*Chair of Fluid Dynamics Faculty Recruitment Committee, 1996.*

*Member of Activities Committee, 1996–1997; Chair, 2000–2005.*

*Member of ad hoc committee tasked to review current ME undergraduate and graduate curricula, and propose necessary changes for revitalization, 1996–1997.*

*Chair of ad hoc committee tasked with updating of Graduate Studies Brochure and creating corresponding Web page, 1996–1997.*

*Chair of Computing Curriculum Subcommittee, 1996–1997.*

*Member of New Mechanical Engineering Building Committee, 1996 & 1998.*

*Chair of Computing Committee, 1997–pres.*

*Chair of Thermal-Fluid Sciences Area Committee, 1998–1999.*

*Member of Mechanics Search Committee, 1998 & 2000.*

*Member of Advancement Committee, 1998–2000.*

*Chair of Computational Mechanics Search Committee, 2001.*

*Member of Tenure and Promotion Committee, 2005–pres.*

*Initiated development of new undergraduate program/curriculum to attract gifted undergraduates to the Mechanical Engineering Department.*

## Thesis Committees

*Served on seven PhD committees while at UCLA:*

*Jeffrey C. Buell (1986) Mechanical, Aerospace and Nuclear Engineering*  
*Dimitrios A. Goussis (1986) Mechanical, Aerospace and Nuclear Engineering*  
*Han Sik Lee (1986) Mechanical, Aerospace and Nuclear Engineering*  
*Larry W. Swanson (1987) Mechanical, Aerospace and Nuclear Engineering*  
*Stephen D. Heister (1988) Mechanical, Aerospace and Nuclear Engineering*  
*Farrouk Isaacci (1989) Mechanical, Aerospace and Nuclear Engineering*  
*Richard S. Parnas (1990) Chemical Engineering*

*Served on four MS committees while at UCLA:*

*Thomas G. Kalman (1987) Mechanical, Aerospace and Nuclear Engineering*  
*Daniel Klein (1987) Mechanical, Aerospace and Nuclear Engineering*  
*Gregory L. Roche (1988) Mechanical, Aerospace and Nuclear Engineering*  
*J.-S. Peng (1990) Mechanical, Aerospace and Nuclear Engineering*

*Served on 15 PhD committees at UK:*

*Zhigang Xu (1993) Physics and Astronomy [Graduate School Outside Examiner]*  
*Jian Ye (1993) Mechanical Engineering*  
*John Baker (1994) Mechanical Engineering*  
*Yaoshan Chen (1994) Mechanical Engineering*  
*Li Q. Tang (1994) Chemical Engineering*  
*Yue Zhang (1994) Mathematics [Graduate School Outside Examiner]*  
*Douglas C. Denger (1996) Mechanical Engineering*  
*Wei Hu (1997) Mathematics [Graduate School Outside Examiner]*  
*Joe Christensen (1997) Physics and Astronomy*  
*Christopher Thron (1997) Physics and Astronomy*  
*Abraham J. Salazar (1998) Mechanical Engineering*  
*Douglas Riley (1999) Mathematics*  
*Matthew Barker (2000) Statistics [Graduate School Outside Examiner]*  
*Zhiping Wang (2001) Mechanical Engineering*  
*Yinhui Liu (2005) Civil Engineering [Graduate School Outside Examiner]*

*Served on 10 MS committees at UK:*

*Sudip Mukerji (1994) Mechanical Engineering*  
*Derong Wang (1996) Computer Science*  
*Jiqing Zhang (1996) Mining Engineering*  
*Harald Roclawski (2001) Mechanical Engineering*  
*Ronita Nandy (2002) Mechanical Engineering*  
*Ravi Kanda (2003) Geological Sciences*  
*Ravinder B. Siripuram (2003) Mechanical Engineering*  
*Rahul Bharadwaj (2003) Mechanical Engineering*  
*James Booth (2003) Mathematics*  
*Ying Xu (2005) Mathematics*

*Chaired committees of four PhD students who have graduated from UK:*

*Yunpeng Yang (1996) Mechanical Engineering*  
*E. Carl Hylin (1997) Mechanical Engineering*  
*Sudip Mukerji (1997) Mechanical Engineering*  
*David C. Weatherly (1998) Mechanical Engineering*

*Currently co-chairing (with K. A. Tagavi) committee of one PhD student:*

*Ying Xu, expected to receive PhD in Mechanical Engineering, Aug. 2006.*

*Chaired (or co-chaired) committees of five MS students who have graduated from UK:*

*Liyan Wang (1993) Mechanical Engineering*  
*Victor E. Garzón (1997) Mechanical Engineering (Co-Chair, Kozo Saito)*  
*Yuqi Chen (1999) Mechanical Engineering (Co-Chair, K. A. Tagavi)*  
*Stewart A. Bible (2003) Mechanical Engineering*  
*Illyathambi Kunadian, (2004) Mechanical Engineering (Co-Chair, K. A. Tagavi)*

*Currently chairing (or co-chairing) committees of two MS students:*

*Chetan Babu Velkur*  
*Abihshek Tiwari (committee co-chair K. A. Tagavi)*

*Currently serving on five additional PhD committees at UK:*

*Zhiyu Shao Civil Engineering*  
*Basil Wong Mechanical Engineering*  
*Mridupawan Deka Physics and Astronomy*  
*Dmytro Goykolov Physics and Astronomy*  
*Arvind Santhanakrishnan Mechanical Engineering*

## **Other Educational Activities**

*NSF REU (Research Experiences for Undergraduates) Mentor, 1995–1998; mentored the following students:*

*Mr. J. D. Chamberlain (1995)*  
*Ms. Serena Chung (1996)*  
*Mr. Lee R. Gibson (1997)*  
*Ms. Marisa Gioioso (1998)*

*Mentored University of Kentucky Undergraduates in ME 395 Individual Studies Research Courses:*

*Brian Kendig (1999)*  
*Stewart Bible (2000)*  
*David Joyce (2001)*  
*Jeremy Slade (2001)*  
*John Holloway (2002, 2003)*  
*Mun-Gwen Chong (2003, 2004)*

*Brett Compton (2005, 2006)*

*Michael Mudd (2005, 2006)*

*Mentoring visiting PhD candidate, Mr. Ali Ziaei from Shiraz University, Iran, (2005–2006)*

#### *Courses Taught*

##### *Undergraduate:*

*ME 220 Introductory Thermodynamics*

*ME 330 Introductory Fluid Mechanics*

*ME 321 Advanced Thermodynamics*

*ME 380 Undergraduate Computational Fluid Dynamics*

##### *Graduate:*

*MA 537 Introduction to Numerical Analysis (Cross listed among Mathematics [MA], Computer Science [CS] and general engineering [EGR])*

*ME 631 Fluid Mechanics II*

*ME 634 Introduction to Turbulence*

*ME 690 Advanced Computational Numerical Analysis*

*ME 699a Computational Fluid Dynamics of Incompressible Flow*

*ME 699b Computational Fluid Dynamics of Compressible Flow*

*Science Magnet Program Mentor, P. L. Dunbar High School, Lexington, KY, 1995–present; mentored the following students:*

*Ms. Marcia Cooper (1995) (Received PhD in Mechanical Engineering from Cal Tech, 2004)*

*Mr. Matthew Gaetke (1996) (Attended MIT as undergraduate)*

*Mr. Warren Chow (1997) (Attended MIT as undergraduate, now in medical school at UCLA)*

*Mr. Alex Popkin (1999) (Currently PhD student in mathematics at Vanderbilt University)*

*Mr. Brad Pabian (2000) (Currently a senior at the University of Kentucky)*

*Mr. Andrew Loh (2003) (Currently a junior at the University of Michigan)*

## OTHER INFORMATION

### Work in Progress

#### Journal Articles

*J. H. Booth, P. D. Hislop, J. M. McDonough and T. Yang, “A Bifurcation Theory Analysis of the Transition to Turbulence for Burgers’ Equation. I. The Small-Scale Model.” (in preparation for submission to Mathematics of Computation)*

*J. M. McDonough and T. Yang, “A Simple, Low-Order Accurate, Efficient Discrete Mollification Procedure.” (in preparation for submission to Journal of Computational Physics)*

*Ying Xu, J. M. McDonough, T. Yang and K. A. Tagavi, “Comparison of Numerical Solidification Nucleation Sizes with Theory.” (in preparation for submission to J. Appl. Mech.)*

*J. M. McDonough, J. C. Holloway and M. G. Chong, “A Discrete Dynamical System Model of Temporal Fluctuations in Turbulent Convection.” (in preparation for submission to J. Fluid Mech.)*

*C. B. Velkur and J. M. McDonough, “Analysis of the Compressible ‘Poor Man’s Navier–Stokes Equation’ Discrete Dynamical System.” (in preparation for submission to SIAM Appl. Dyn. Sys.)*

## Lecture Notes/Books

*Lectures in Basic Fluid Mechanics.* Used in teaching the first course in undergraduate fluid mechanics from 1987–89 at UCLA, and from 1990–pres. at UK. Downloadable PDF version available at <http://www.engr.uky.edu/~acfd>.

*Lectures in Basic Computational Numerical Analysis.* Has been used as the main text for advanced undergraduate and beginning graduate classes in engineering computations at UCLA since 1980 and at UK since 1992; was used for a similar course by the UK Mathematics Department in Fall '96 and again since Fall '03; has been sought by various publishers (e.g., North Holland/Elsevier, Prentice-Hall, Springer-Verlag and DCW Industries, Inc., CRC). Downloadable PDF version available at <http://www.engr.uky.edu/~acfd>.

*Lectures in Advanced Computational Numerical Analysis.* Was used as main text for advanced graduate engineering computation class at UCLA from 1984 through 1989. Forms the basis for the course material of new graduate level computation class at UK, ME 690. Downloadable PDF version available at <http://www.engr.uky.edu/~acfd>.

*Lectures on Incompressible Computational Fluid Dynamics.* Being used for new UK advanced graduate course in viscous, incompressible computational fluid dynamics. Downloadable PDF version available at <http://www.engr.uky.edu/~acfd>.

*Lectures on Compressible Flow Simulation.* Being used for new UK advanced graduate class in computational fluid dynamics for compressible flow. Hand-written manuscript still under development.

*Introductory Lectures on Turbulence: Physics, Mathematics and Modeling.* Used for UK advanced graduate course in turbulent fluid flow. Downloadable PDF version available at <http://www.engr.uky.edu/~acfd>.

*Lectures in Advanced Undergraduate Engineering Thermodynamics.* Handwritten notes only.

## New Research Areas

1. Development of high-resolution, multi-scale models of interactions of turbulence with other physical phenomena, especially chemical kinetics, radiation, porous media and surface roughness using nonlinear discrete dynamical systems employed as part of new subgrid-scale model for large-eddy simulation (LES). These consist of two main parts: i) the discrete dynamical system, derived from the governing equations of the physical phenomena, and ii) amplitude factors obtained via local calculation of structure functions and use of a generalization of Kolmogorov-like scaling laws.
2. Analysis and testing of different approach to construction and application of filters for LES of turbulent flows, based on simple discrete approximation of typical mollifiers employed in theoretical analysis of PDEs and applied to the computed solutions, rather than the equations.
3. Construction of complete LES code based on straightforward, standard numerical analysis and implemented using the following three ideas: i) filter solutions (signal processing) instead of equations (mollification); ii) model physical subgrid-scale variables rather than their correlations using constructions not too different from pseudo-differential operators; and iii) directly use model results to enhance fidelity of under-resolved large-scale computations via a multi-scale approach.
4. Simulation and modeling of forest fire spread rates using porous medium model of forest.

5. *Initial studies of LES applied to the study of insect flight.*
6. *Initial studies of LES of compressible flow: investigation of effects of turbulence on blast wave propagation.*
7. *Applications of CFD to specific industrial problems: turbine blade cooling, diffuser and pump design, liquid rocket engine component performance analysis, coal mine shaft air quality during continuous mining.*
8. *Development of new (and simple) highly-parallelizable multigrid/domain decomposition Poisson equation solver exhibiting essentially  $\mathcal{O}(N)$  total arithmetic on a single processor.*
9. *Investigation of new differential operator based interpolation schemes for use in high-fidelity turbulence models.*
10. *Use of 3-D immersive interactive visualization both in research (analysis of computed results, and experimental data) and in the classroom.*

## UK-Funded Research

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): none*

*Feasibility Study of IRIM Image/Airflow Correlation*

*Center for Robotics and Manufacturing Systems (cost-sharing with General Electric)*

*07/01/90–12/31/90. (\$3,836)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): none*

*Computer Graphics for Flow Visualization of Computational Fluid Dynamics (CFD) Results*

*UK Center for Computational Sciences*

*07/01/90–06/30/91 (\$12,000)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): none*

*Numerical Simulation of Jet Interaction with a Hypersonic Crossflow*

*UK Center for Computational Sciences*

*07/01/91–06/30/92 (\$14,500)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): none*

*UK Major Research Equipment Competition, 92-MREC-39*

*(\$36,419 + \$30,000 from College of Engineering)*

*Principal Investigator: S. D. Gedney*

*Co-Principal Investigator(s): J. M. McDonough, et al.*

*UK Major Research Equipment Competition, 92-MREC-35*

*(\$50,000 + \$50,000 from College of Engineering)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): none*

*Numerical Simulation of Jet Interaction with a Hypersonic Crossflow*

*UK Center for Computational Sciences*

*07/01/92–06/30/93 (\$14,500)*

*Principal Investigator: J. M. McDonough*

*Co-Principal Investigator(s): none*

*Numerical Simulation of Jet Interaction with a Hypersonic Crossflow*

*UK Center for Computational Sciences*

07/01/93–06/30/94 (\$7,250)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

Additive Turbulent Decomposition of the Incompressible and Compressible Navier-Stokes Equations  
UK Research and Graduate Studies

07/01/92–06/30/94 (\$24,000)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

Advanced Turbulence Models for Heat Transfer in Air Circuits of Gas Turbine Blades  
UK Center for Computational Sciences matching for NASA/EPSCoR Grant

01/01/96–06/30/96 (\$6,600)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

Three-Dimensional Small-Scale Additive Turbulent Decomposition for Radiation-Turbulence Interactions in Soot-Laden Diffusion Flames

UK Center for Computational Sciences

01/07/96–06/30/97 (\$14,210)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

“Bridge” Funding to Support PhD Candidate During Final Two Months of Thesis Preparation

UK Office of Research and Graduate Studies

04/01/97–06/30/97 (\$2,500)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

“Subgrid-Scale Modeling of Turbulent Combustion Via Discrete Dynamical Systems”

UK Center for Computational Sciences matching for NASA/EPSCoR Grant

06/01/99–05/31/00 (\$14,400)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

Support of post-doctoral scholar, half time

UK Center for Computational Sciences matching for AFOSR Grant

06/01/01–05/31/02 (\$14,000)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

“Discrete Dynamical Systems Subgrid-Scale Models of Turbulent Combustion”

UK Center for Computational Sciences matching for NASA/EPSCoR Grant

06/01/02–05/31/03 (\$8,474)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

Support of post-doctoral scholar.

UK Center for Computational Sciences

06/01/02–05/31/03 (\$30,000)

Principal Investigator: J. M. McDonough

Co-Principal Investigator(s): none

“Implementation of Discrete Dynamical System SGS Models in New LES Code for Turbulent Combustion”

UK Center for Computational Sciences matching for NASA/EPSCoR Grant

06/01/03–05/31/04 (\$8,070)

*Principal Investigator: J. M. McDonough*  
*Co-Principal Investigator(s): none*  
*Support of post-doctoral scholar.*  
*UK Center for Computational Sciences*  
*06/01/03-05/31/04 (\$30,000)*