

## CURRICULUM VITAE

### **Dr. SEDAT BIRINGEN**

Professor, Department of Aerospace Engineering Sciences  
University of Colorado at Boulder  
Boulder, CO 80309

(303) 492-2760  
email: biringen@spot.colorado.edu

### **I. RESEARCH INTERESTS**

Computational Fluid Mechanics, Transition and Turbulence, Flow Control, Atmospheric Boundary Layer and Wind Energy, Numerical Heat Transfer, Biological Fluid Dynamics.

### **II. EDUCATION**

D.Sc. in Applied Mechanics, Universite Libre de Bruxelles, Belgium.  
Diploma, von Karman Institute for Fluid Dynamics, Bruxelles, Belgium.  
B.S., M.S. in Mechanical Engineering, Robert College, Istanbul, Turkey.

### **III. PROFESSIONAL EXPERIENCE**

1993-	Professor, Aerospace Engineering Sciences, University of Colorado, Boulder.
1995-1996	(Interim) Assistant Vice Chancellor for Research, University of Colorado, Boulder.
1986-1993	Associate Professor, Aerospace Engineering Sciences, University of Colorado, Boulder.
1984-1986	Associate Professor, Department of Mechanical Engineering, University of New Hampshire, Durham.
1981-1984	Affiliated Research Scientist, NASA/Langley Research Center (also Research Associate Professor, Old Dominion University, Norfolk, Virginia).
1978-1981	Research Scientist and Program Manager, Nielsen Engineering and Research, Inc., Mountain View, California.
1975-1978	Assistant Professor, Bogazici University (Robert College), Istanbul, Turkey.
1994-1995	Visiting Professor, Dept. Mechanical Engng., Columbia University and Comp. Math Group, Princeton University.

1977-1978                      Visiting Professor, Department of Mechanical Engineering,  
Stanford                      University.

#### **IV. CURRENT RESEARCH INTERESTS**

Turbulent Flow Control for Drag Reduction.

Computational Study of Laminar Flow Transition and Transition Control in Compressible Shear Flows. Application to Parallel Processing.

Direct Simulation of Complex Turbulent Flows: Application to Environmental Problems, Planetary Boundary Layer and Oceanographic Flows, Wind Energy.

in rural areas).

#### **V. TEACHING (G: Graduate, U: Undergraduate)**

Advanced Computational Fluid Mechanics (G),	Turbulent Flow Computation (G)
Introduction to Turbulence (G)	Advanced Fluid Mechanics (G)
Environmental Fluid Dynamics (G)	Macroscopic Physics of Fluids (G)
Computational Fluid Mechanics (G/U )	Fluid Mechanics (U)
Thermodynamics and Heat Transfer (U)	Aerodynamics I (U)
Mechanics I - Statics (U)	Mechanics II - Dynamics (U)
Numerical Mathematics (U/G)	Compressible Flow (U/G)
Viscous Flows (G)	

#### **VI. STUDENT SUPERVISION**

##### **Ph.D Theses**

##### **a. Principal Advisor**

*A. Saati*, "Numerical Simulation of Compressible Couette Flow Stability."

*Gokhan Danabasoglu*, "Spatial Simulation of Transition in Wall-Bounded Shear Flows: Active Control and Effects of Surface Roughness."

*L. Joel Peltier*, "Numerical Simulation of Time-Dependent Thermocapillary Convection in Single and Encapsulated Fluid Layers."

*Asmund Huser*, "Direct Simulation of Turbulent Flow in a Square Duct."

*Ferhat Hatay*, "Direct Numerical Simulation of Transitional and Turbulent Compressible Wall Shear Layers."

*Stuart Marlatt*, "Direct Numerical Simulation of Ekman Layer Transition and Turbulence."

*Eileen Saiki* , "Spatial Numerical Solution of Boundary Layer Transition: Effects of a Spherical Particle."

*Robert Reichert*, "Numerical Simulation of Compressible Flows With Application to Noise Control."

*Scott Waggy*, "Turbulent Transport in the Atmospheric Boundary Layer With Application to Wind farm Dynamics."

*Alec Kucala*, "Control of Transitional and Turbulent Flows Using Direct Numerical Simulation"

*Alan Hsieh*, "Direct Numerical Simulation of Complex Turbulent Flows."

*Armin Kianfar*, "Drag Reduction and Turbulence Control by Subsurface Elastic Materials" (new Ph.D. student).

#### **b. Co-Avisor**

*Bilal, O.R.*, "Design and Optimization of Phononic Crystals and Metamaterials for Flow Control and Other Applications."

#### **Undergraduate Research Opportunities Projects (UROP)**

*Keith Wilkins*, "Influence of Gravity Modulation on Transport Properties".

*Todd Eastman*, "A Finite Difference Method With Direct Solvers for Thermally-Driven Cavity Problems".

*Andy Brunn* , "Turbulent Boundary Layer Calculation."

*Robert Reichert* , "Flow Visualization in Particle-Wave Interaction in Boundary Layers."

*Alexi Rakow* , "Flow Visualization".

*Mark Donohue*, "Aircraft Icing."

*Farheen Rizvi*, "Low Reynolds Number Airfoil Design."

*Brandon Yonko*, "Transition and Turbulence Control."

*Nick Little, Mikhael Kosyan, Trent Hanson, Peter van Dyke*, "Efficient Design of Wind Turbine Blades."

*Joshua Bromberg*, "Experimental Investigation of Flow Around a Rotating Airfoil."

*Cesar Galan*, "Using DNS Data For Testing Turbulence Models."

**In addition, served on more than 30 M.S. and Ph.D. committees of graduate students from different engineering departments.**

## VII. PUBLICATIONS

### Books

**An Introduction to Computational Fluid Mechanics by Example.**

S. Biringen and C.-Y. Chow, Wiley (2011).

**Industrial and Environmental Applications of Direct and Large Eddy Simulation: Proc. Workshop Held in Istanbul, Turkey, 5-7 August, 1998.**

S. Biringen et al. (ed), Springer, 1999.

### Refereed Journal Articles

Biringen, S. 1978 Calculation of axisymmetric jets and wakes with a three-equation model of turbulence.

*J. Fluid Mech.* **86**, 52-67.

Biringen, S. and Levi, J. 1978 Calculation of two-dimensional turbulent boundary layers.

*AIAA Journal* **16**, 1016-1019.

Biringen, S. and Reynolds W.C. 1981 Large-eddy simulation of the shear-free turbulent boundary layer.

*J. Fluid Mech.* **103**, 53-63

Biringen, S. 1981 A note on the stability of the one-dimensional model convection-diffusion equation.

*J. Comp. Appl. Math.* **7**, 17-20.

Biringen, S. 1984 Numerical simulation of inlet flow fields.

*J. Aircraft* **21**, 244-249.

Biringen, S. and Maestrello, L. 1984 Development of spot-like turbulence in plane channel flow.

*Phys. Fluids* **27**, 318-321.

Biringen, S. 1984 Final stages of transition in plane channel flow.

*J. Fluid Mech.* **148**, 413-442.

- Biringen, S. 1984 Active control of laminar flow transition by periodic suction-blowing.  
*Phys. Fluids* **27**, 1345-1347.
- Biringen, S. and Abdol -Hamid, K. 1985 A turbulent transport model for free-shear flows.  
*AIAA Journal*. **23**, 1629-1931.
- Biringen, S. 1987 Three-dimensional vortical structures of transition in plane channel flow.  
*Phys. Fluids* **30**, 3359-3368.
- Biringen, S., Nutt, W.E. and Caruso, M.J. 1987 Numerical experiments on transition control by periodic suction-blowing.  
*AIAA Journal*. **25**, 235-244.
- Biringen, S. and Abdol-Hamid, K. 1987 modeling and calculation of turbulent transport in free-shear flows.  
*Num. Heat Trans.* **11**, 57-67.
- Biringen, S. and Cook, C. 1988 On pressure boundary conditions for the incompressible Navier-Stokes equations using non-staggered grids.  
*Num. Heat Trans.* **13**, 241-252.
- Biringen, S. and Kao, K.H. 1989 On the application of pseudo-spectral FFT technique to non-periodic problems.  
*Int. J. Num. Meth. in Fluids* **9**, 1235-1267
- Biringen, S. and Danabasoglu, G. 1989 Oscillatory flow with heat transfer in a square cavity.  
*Phys. Fluids A* **1**, 1796-1812.
- Biringen, S. and Saati, A. 1990 A comparison of several finite difference methods for viscous and inviscid problems.  
*J. Aircraft* **27**, 90-92.
- Biringen, S. 1990 Numerical simulation of nonlinear structures in final stages of transition in plane channel flow.  
*AIAA Journal* **28**, 365-367.
- Saati, A., Biringen, S. and Farhat, C. 1990 Solving Navier-Stokes equations on a massively parallel processor: beyond the one gigaflop performance.  
*Int. J. Supercomp. Appl.* **4**, 72-80.

Biringen, S. and Peltier, L.J. 1990 Numerical simulation of 3-D Benard convection with gravitational modulation.

***Phys. Fluids A* 2, 754-764.**

Biringen, S. and Laurien, E. 1990 Nonlinear structures of transition in wall-bounded flows.

***J. Appl. Num. Math.* 7,129-150.**

Biringen, S. and Danabasoglu, G. 1990 Computation of convective flow with gravity modulation in rectangular cavities.

***J. Thermophys. Heat Trans.* 4, 357-365.**

Danabasoglu, G. and Biringen, S. 1990 A Chebyshev matrix method for the spatial modes of the Orr-Sommerfeld equation.

***Int. J. Num. Meth. in Fluids* 11, 1033-1037.**

Peltier, L.J., Biringen, S. and Chait, A. 1990 A comparison of finite difference and spectral methods for the three-dimensional diffusion equation.

***Num. Heat Trans. B* 18, 205-219.**

Danabasoglu, G., Saati, A. and Biringen, S. 1991 Three-dimensional simulations of incompressible and compressible flow stability.

***Computer Phys. Comm.* 65, 76-83**

Danabasoglu, G., Biringen, S. and Streett, C.L. 1991 Spatial simulation of instability control by periodic suction blowing.

***Phys. Fluids A* 3, 2138-2147.**

Huser, A. and Biringen, S. 1992 Calculation of wind-driven flow at high Reynolds numbers.

***Int. J. Num. Meth. in Fluids* 14, 1087-1109.**

Hatay, F., Biringen, S., Erlebacher, G. and Zorumski, W.E. 1993 Stability of high speed compressible rotational Couette flow.

***Phys. Fluids A* 5, 393-404.**

Saiki, E., Biringen, S., Danabasoglu, G. and Street, C.L. 1993 Spatial simulation of transition in plane channel flow: comparison of K- and H-type disturbances.

***J. Fluid Mech.* 253, 485-507.**

Peltier, L.J. and Biringen, S. 1993 Time-dependent thermocapillary convection in a rectangular cavity: numerical results for a moderate Prandtl number fluid.

***J. Fluid Mech.* 257, 339-358.**

- Huser, A. and Biringen, S. 1993 Direct numerical simulation of turbulent flow in a square duct: turbulence statistics and structures.  
**J. Fluid Mech.** **257**, 65-96.
- Danabasoglu G. and Biringen, S. and Streett, C.L. 1994 Application of the spectral multi-domain method to the Navier-Stokes equations.  
**J. Comp. Phys.** **113**, 155-164.
- Huser A., Biringen, S. and Hatay, F. 1994 Direct numerical simulation of turbulent flow in a square duct: Reynolds stress budgets.  
**Phys. Fluids** **6**, 3144-3152.
- Reichert, R. Hatay, F., Biringen, S. and Huser, A. 1994 Application of the proper orthogonal decomposition technique to turbulent flow in a square duct.  
**Phys. Fluids** **6**, 3086-3092.
- Marlatt, S. and Biringen S. 1995 Spatial instability modes in the laminar Ekman layer.  
**J. Atmospheric Sciences** **51**, 3539-3542.
- Hatay, F. and Biringen S. 1995 Simulation of early transition in compressible, rotating Couette flow: subharmonic development.  
**Phys. Fluids** **7**, 422-433.
- Marlatt, S.W. and Biringen, S. 1995 Numerical simulation of Ekman layer instability.  
**Phys. Fluids** **7**, 449-451.
- Peltier, L.J., Biringen, S. and Farhangnia, M. 1995 Numerical simulation of time-dependent thermocapillary convection in multiple fluid layers.  
**J. Thermophys. Heat Trans** **9**, 702-707.
- Saiki, E. and Biringen, S. 1996 Computation of steady and unsteady flow over a cylinder by a virtual boundary method.  
**J. Comp. Physics** **123**, 450-465.
- Farhangnia, M., Biringen, S. and Peltier, L.J. 1996 Buoyancy-driven turbulent flow in a rectangular cavity.  
**Int. J. Num. Meth. in Fluids** **23**, 1311-1326.
- Huser, A. and Biringen, S. 1996 Direct numerical simulation of turbulent flow in a square duct: dissipation rate budget.  
**AIAA Journal** **34**, 2509 - 2513.

- Saiki, E. and Biringen, S. 1997 Spatial numerical simulation of boundary layer transition: effects of a spherical particle.  
***J. Fluid Mech.* 345**, 133-164.
- Hatay, F., O'Sullivan, P., Biringen, S. and Bandyopadhyay, P. 1998 Numerical simulation of flows driven by applied Lorentz forces.  
***J. Thermophys. and Heat Trans.* 11**, 446-453.
- O'Sullivan, P. and Biringen, S. 1998 Direct simulations of low-Reynolds number turbulent channel flow with EMHD control.  
***Phys. Fluids* 10(5)**, 1169-1181.
- Hatay, F. and Biringen, S. 1999 Direct numerical simulation of low-Reynolds number supersonic wall shear layers I: mean flow and one-point correlations.  
***Int. J. Fluid Mechanics Research* 26(1)**, 1-16.
- Hatay, F. and Biringen, S. 1999 Direct numerical simulation of low-Reynolds number supersonic wall shear layers II: statistical analysis and energy budgets.  
***Int. J. Fluid Mechanics Research* 26(1)**, 17-35.
- Reichert, R.S. and Biringen, S. 2001 Time-domain simulation of acoustic propagation in a lined duct.  
***Applied Acoustics* 62**, 1049-1068.
- O'Sullivan, P.L., Reichert, R.S., Biringen, S. and Howard, J.E. 2001 Applicability of Thompson boundary conditions to obliquely incident acoustic waves.  
***Applied Acoustics* 62**, 1013-1018.
- O'Sullivan, P.L. and Biringen, S. 2001 Numerical experiments on feedback MHD control of large scale coherent structures in channel turbulence.  
***Acta Mechanica* 152**, 9-17.
- O'Sullivan, P.L., Biringen, S. and Huser, A. 2001 *A priori* evaluation of dynamic subgrid models of turbulence in square duct flow.  
***J. Engng Math.* 40**, 91-108.
- Biringen, S., Howard, J.E. and Reichert, R.S. 2005 Simulation of sonic boom interaction with shear turbulence .  
***Mech. Res. Comm.* 32**, 604-609.
- Reichert, R.S. and Biringen, S. 2007 Spatial simulation of compressible plane jets.  
***Mech. Res. Comm.* 34**, 249-259.



- Marlatt, S.W., Waggy, S.B. and Biringen, S. 2010 Direct numerical simulation of the turbulent Ekman layer: turbulent energy budgets. ***AIAA Thermophys. Heat Trans J.*** **24**, 544-555.
- Akman, O.E., Biringen, S., Waggy, S.B. 2011 Analysis of signal propagation in an elastic-tube flow model. ***Med. Engng. Phys.*** **33**, 660-663.
- Waggy, S., Marlatt, S.W, Biringen, S. 2011 Direct numerical simulation of the turbulent Ekman layer: instantaneous flow structures. ***AIAA Thermophys. Heat Trans. J.*** **25**, 309-318.
- Marlatt, S.W., Waggy, S.B. and Biringen, S. 2012 Direct numerical simulation of the turbulent Ekman Layer: evaluation of closure models. ***J. Atmos. Sci.*** **69** (3) 1106-1117.
- Waggy, S.B., Biringen, S. and Sullivan, P. 2013 Direct simulation of top-down and bottom-up diffusion in the convective atmospheric boundary layer. ***J. Fluid Mech.*** **724**, 581-606.
- Kucala, A and Biringen, S. 2014 Spatial simulation of channel flow instability and control. ***J. Fluid Mech.*** **738**, 105-123.
- Waggy, S.B, Kucala, A. and Biringen, S. 2014 Parallel Implementation of a Navier-Stokes solver: turbulent Ekman layer direct numerical simulation. ***Int. J. Comp. Mech.*** **11**(5), (18 pages).
- Marlatt, S., Waggy, S.B. and Biringen, S. 2014 Reply to Comment on “Direct numerical simulation of the turbulent Ekman Layer: evaluation of closure models.” ***J. Atmos. Sci.*** 71(5),
- Hussein MI, Biringen S, Bilal OR, Kucala A. 2015 Flow stabilization by subsurface phonons. ***Proc. R. Soc. A*** **471**:20140928  
<http://dx.doi.org/10.1098/rspa.2014.0928>.
- Waggy, S., Biringen, S. and Kucala, A. 2015 Wake effects on turbulent transport in the convective boundary layer. ***Geophy. Astrophy. Fluid Dyn.*** **109:5**, 465-579;  
 DOI:10.1080/03091929.2015.1083560

Hsieh, A.S., Biringen, S., and Kucala, A. 2016. Simulation of rotating channel flow with heat transfer: evaluation of closure models.  
*J. Turbomach.* **138**:111009. pp. 1-15.

Waggy, S.B., Hsieh, A.S. and Biringen, S. 2016. Modeling high-order statistics in the turbulent Ekman layer.  
*Geophys. Astro. Fluid.* **110**:391-408.

Hsieh, A.S. and Biringen, S. 2016. The minimal flow unit in complex turbulent flows.  
*Phys. Fluids.* **28**:125102. pp. 1-18

Hsieh, A.S. and Biringen, S. 2017. Universality of a higher-order closure models for turbulent rotating flows.  
*Geophys. Astro. Fluid.* **112**: 156-164.

Hsieh, A.S. and Biringen, S. 2019. Effects of rotation on turbulence production.  
*App. Math Phys.* **7**: 1-33.

**In addition: About 140 Conference Proceedings, Abstracts and Reports.**

**VIII. GRANTS AND CONTRACTS**

*Numerical simulation of separated flows* (research initiation). PI; Robert College Research Foundation.  
\$1,000.

*Numerical simulation of inlet flow fields.* Co-PI; NASA/Langley.  
\$150,000.

*Numerical simulation of transitional flows.* PI; NASA/Langley.  
\$335,000.

*Modeling of circulation in the gulf of Maine.* PI; Univ. New Hampshire Hubbard Fund;  
\$36,000.

*Effects of gravity modulation at microgravity.* PI; University of Colorado.  
\$45,000 (from a block grant awarded by NASA Headquarters to the Center for Low Gravity Fluid Mechanics and Transport Phenomena).

*Investigation of wave trails.* Co-PI; NASA/Langley.  
\$20,000.

*Transition in wall-bounded flows.* PI; NASA/Langley.  
\$79,500.

*G-jitter in microgravity.* PI; NASA/Lewis.  
\$70,000.

*Numerical simulation of transition in compressible boundary layers on the Connection Machine.* PI; NSF.  
\$30,000.

*Interfacial phenomena in multilayered fluid systems.* Co-I;  
NASA Headquarters.  
\$1,200,000.

*Numerical Simulation of stability and stability control in compressible Couette flow.* PI;  
NASA Langley .  
\$110,000 (1990-93).

*A numerical investigation of roughness effects on boundary layer transition.* PI; NASA  
Langley.  
\$135,000.

*Particle-wave interaction in boundary layer instability.* PI; ONR.  
\$175,000.

*Numerical Simulation of Shock-Turbulent Boundary Layer Interaction.* PI; NASA  
Langley.  
\$60,000.

*Aeroacoustics.* PI; NASA Langley.  
\$66,000.

*Computational Analysis of Bow Thrusters.* PI; ONR.  
\$105,000.

*Fluid-Structure Interaction.* PI; NASA Ames.  
\$80,000.

*Advanced Aeroacoustic Nacelle design.* PI; NASA Langley..  
\$375,000.

*Numerical Simulation of MHD Turbulence and Flow Control* PI; ONR  
\$235,000.

*Modeling of Unsteady Flow in the Pulmonary Artery* Co-PI; University of Colorado, Bioengineering Initiative.  
\$20,000.

*International Workshop on "Industrial and Geophysical Applications of DNS/LES."* PI; NSF, ONR-Europe.  
\$20,000.

*High-Performance Simulation of Multiphysics Problems.* Co-I; NSF  
\$1,800,000.

*Quiet Supersonic Transport Design.* Co-I; DARPA  
\$350,000.

*Phononic Surfaces for Flow Control (2011 – 2015).* Co-PI; NSF - IDR  
\$517,500 (50% share).

*Turbulence Control by Phonons (2015 – 2016).* Co-PI; AFSOR (seed grant)  
\$60,000 (50% share).

*Phononic Subsurfaces: A New Drag Reduction Paradigm (2017-2019).* Co-PI;  
Boeing Co. \$24,980 (50% share).