

Gustaaf B. Jacobs

Office:

Department of Aerospace Engineering
& Engineering Mechanics
San Diego State University
5500 Campanile Drive
San Diego, CA, 92182
Ph. 619-594-4046

<http://attila.sdsu.edu/~jacobs>

gjacobs@mail.sdsu.edu

Education

Ph.D. 2003, Mechanical Engineering, University of Illinois at Chicago.

Thesis Title: *Numerical Simulation of Two-Phase Turbulent Compressible Flows with a Multidomain Spectral Method.*

Thesis Advisor: Farzad Mashayek

M.S. 1998, Aerospace Engineering, Delft University of Technology.

Thesis Title: *Numerical Investigation on Drag Reduction of a 2D Bluff Body through Guiding Vanes.*

Employment History

- Fall 2006-present, **Assistant Professor**, Department of Aerospace Engineering and Engineering Mechanics, San Diego State University.
 - Fall 2006-present, **Assistant Professor**, Computational Science Research Center, San Diego State University.
 - Fall 2003-Summer 2006, **Visiting Assistant Professor**, Division of Applied Mathematics, Brown University.
 - Fall 2004-Summer 2006, **Postdoctoral Associate**, Department of Mechanical Engineering, Massachusetts Institute of Technology.
 - Fall 2000-Spring 2003, **Research Assistant**, Department of Mechanical Engineering, University of Illinois at Chicago.
 - Fall 1999-Spring 2000, **Research Assistant**, Department of Mechanical Engineering, University of Hawaii at Manoa.
 - March 1999-July 1999, **Technical Analyst**, Technical Analysis, DAF Trucks, Eindhoven, The Netherlands.
 - October 1998-February 1999, **Added Researcher**, Faculty of Aerospace Engineering, Delft University of Technology.
 - April 1997-August 1997, **R&D Intern**, R&D, Organon-Teknika, AKZO-Nobel, Boxtel, The Netherlands.
-

Publications

In Preparation

1. Jacobs, G.B., Armstrong, K., *"Inertial Particle Dispersion in the Lagrangian Wake of a Square Cylinder"*.
2. Haller, G., Surana, A., Jacobs, G.B., *"A Criterion to Detect Open Separation"*, invited paper for Chaos.

Completed Manuscripts

1. Jacobs, G.B., Don, W.S., Dittmann, T., *"Computation of Normal Shocks Running into a Cloud of Particles using a High-Order Particle-Source-in-Cell Method"*, - to be submitted to J. of Prop. and Power.
2. Hoogedoorn, E.E., Jacobs, G.B., Beyene, A., *"Effect of Flexibility on Part-Load Performance of a Wind Turbine Blade: an Aerodynamic Study"*, - under revision to Energy, The International Journal (2008).
3. Jacobs, G.B., Hesthaven, J.S., *"Implicit-Explicit Time Integration of a High-Order Particle-in-Cell Method with Hyperbolic Divergence Cleaning"*, Comp. Phys. Comm., to appear (2009).
4. Sengupta, K., Jacobs, G.B., Mashayek, F., *"Large-Eddy Simulation of Compressible Flows Using a Spectral Multi-Domain Method"*, Int. J. Num. Meth. Fluids, - to appear (2009).
5. Sengupta, K., Shotorban, B., Jacobs, G.B., Mashayek, F., *"Spectral-Based Simulations of Particle-Laden, Turbulent Flow"*, Int. J. Multiphase Flow, - to appear (2009).

Journal Papers

1. Jacobs, G.B., Don, W.S., *"A High Order WENO-Z Finite Difference-Based Particle-Source-in-Cell Method for Computation of Particle-Laden Flows with Shocks"*, J. Comp. Phys., 228 (5), 2009.
2. Surana, A., Jacobs, G.B., Grunberg O., Haller G., *"An Exact Theory of Three-Dimensional Fixed Separation in Unsteady Flows"*, Phys. Fluids, 20 (10), 2008.
3. Weldon, M., Peacock, T., Jacobs, G.B., Helu, M., Haller, G., *"Experimental and Numerical Investigation of the Kinematic Theory of Unsteady Separation"*, J. Fluid Mech., 611, 1-11, 2008.
4. Shah, P., Rovagnati, B., Mashayek, F., Jacobs, G.B., *"Subsonic Compressible Flow in Two-Sided Lid-Driven Cavity. Part II: Unequal Wall Temperatures"*, Int. J. Heat and Mass Transf., 50, 4219-4228, 2007.
5. Shah, P., Rovagnati, B., Mashayek, F., Jacobs, G.B., *"Subsonic Compressible Flow in Two-Sided Lid-Driven Cavity. Part I: Equal Wall Temperatures"*, Int. J. Heat and Mass Transf., 50, 4206-4218, 2007.
6. Jacobs, G.B., Kopriva, D.A., Mashayek, F., *"Towards Efficient Tracking of Inertial Particles with High-Order Multidomain Methods"*, J. Comp. and Appl. Math., 206, 392-408, 2007.
7. Surana, A., Jacobs, G.B., Haller, G., *"Extraction of Separation and Reattachment Surfaces from 3D Steady Shear Flows"*, AIAA J., 45 (6), 1290-1302, 2007.
8. Jacobs, G.B., Kopriva, D.A., Mashayek, F., *"A Conservative Isothermal Wall Boundary Condition for the Compressible Navier-Stokes Equations"*, J. Sci. Comp., 30 (2), 177-192, 2007.
9. Kilic, M.S., Jacobs, G.B., Hesthaven, J.S., Haller, G., *"Reduced Navier-Stokes Equations near a Flow Boundary"*, Physica D, 217 (2), 161-185, 2006.

10. Jacobs, G.B., Hesthaven, J.S., "*High-Order Nodal Discontinuous Galerkin Particle-In-Cell Method on Unstructured Grids*", J. Comp. Phys., 214 (1), 96-121, 2006.
11. Jacobs, G.B., Kopriva, D.A., Mashayek, F., "*Validation Study of a Multidomain Spectral Code for Simulation of Turbulent Flows*", AIAA J., 43 (6), 1256-1264, 2005.
12. Jacobs, G.B., Kopriva, D.A., Mashayek, F., "*Compressible Subsonic Particle-Laden Flow over a Square Cylinder*", AIAA J. of Prop. and Power, 20 (2), 353-360, 2004.
13. Jacobs, G.B., Kopriva, D.A., Mashayek, F., "*A Comparison of Outflow Boundary Conditions for the Multidomain Staggered-Grid Spectral Method*", Num. Heat Transfer, Part B, 44, 225-251, 2003.
14. Mashayek, F., Jacobs, G.B., "*Temperature-Dependent Reaction in Droplet-Laden Homogeneous Turbulence*", Num. Heat Transfer, Part A, 39, 101-121, 2001.

Book Chapter

1. Jacobs, G.B., Pandya, R.V.R., Shotorban, B., Gao, Z., Mashayek, F., "*Deterministic and Probabilistic Approaches for Prediction of Two-Phase Turbulent Flow in Liquid-Fuel Combustors*", in Roy, G.D., editor, Combustion Processes in Propulsion, Chapter 3, Elsevier Science and Technology Bookstore, 2005.

Conference Papers (Peer reviewed)

1. Jacobs, G.B., Armstrong, K., "*Inertial Particle Dispersion in the Lagrangian Wake of a Square Cylinder*", AIAA Paper 2009-1026, 2009.
2. Jacobs, G.B., Don, W.S., Dittmann, T., "*Computation of Normal Shocks Running into a Cloud of Particles using a High-Order Particle-Source-in-Cell Method*", AIAA Paper 2009-1310, 2009.
3. Hoogedoorn, E.E., Jacobs, G.B., Beyene, A., "*Effect of Flexibility on Part-Load Performance of a Wind Turbine Blade: an Aerodynamic Study*", in Proceedings (Vol. III) of 21st International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems, Cracow-Gliwice, Poland, 2008.
4. Jacobs, G.B., "*Inertial Particle Behavior in a Separated, Turbulent Flow*", AIAA Paper 2008-1159, 2008.
5. Sengupta, K., Mashayek, F., Jacobs, G.B., "*Direct Simulation of Turbulent Flows Using Spectral Methods*", AIAA Paper 2008-1450, 2008.
6. Jacobs, G.B., Surana, A., Peacock, T., Haller, G., "*Identification of Flow Separation in Three and Four Dimensions*", AIAA Paper 2007-1171, 2007.
7. Sengupta, K., Jacobs, G.B., and Mashayek, F., "*Large-Eddy Simulation Using a High-Order Nodal Discontinuous Galerkin Method on Unstructured Grids*", AIAA Paper 2007-0402, 2007.
8. Sengupta, K., Jacobs, G.B., and Mashayek, F., "*Large-Eddy Simulation Using a High-Order Nodal Discontinuous Galerkin Method on Unstructured Grids*", ASME Paper IMECE-2006-16050, 2006.
9. Jacobs, G.B., Lapenta, G., Hesthaven, J.S., "*Simulations of Plasmas with a High-Order Discontinuous Galerkin Particle-In-Cell Solver*", AIAA Paper 2006-1171, 2006.
10. Jacobs, G.B., Kopriva, D.A., Mashayek, F., "*Validation Study of a Multidomain Spectral Method for Simulation of Turbulent Flows*", AIAA Paper 2004-0659, 2004.
11. Jacobs, G.B., Gao, Z., Pandya, R.V.R., Shotorban, B., Mashayek, F., "*Numerical Simulation of Two-Phase Flows, Prediction/Control of Combustion in Liquid-Fuel Combustors*", International Colloquium on Combustion Control, Cranfield, UK, August 2003.

12. Jacobs, G.B., Kopriva, D.A., Mashayek, F., "*Compressibility Effects on the Subsonic Two-Phase Flow over a Rectangular Cylinder*", AIAA Paper 2002-3595, 2002.
13. Jacobs, G.B., Kopriva, D.A., Mashayek, F., "*Outflow Boundary Conditions for the Multidomain Staggered-Grid Spectral Method for the Navier-Stokes Equations*", AIAA Paper 2002-0903, 2002.
14. Mashayek, F., Pandya, R.V.R., Jacobs, G.B., Liao, S., "*Two-Phase Models Assessment via DNS*", The 2nd International Symposium on Turbulence and Shear Flow Phenomena, Stockholm, Sweden, June 27-29, 2001.
15. Jacobs, G.B., Kopriva, D.A., and Mashayek, F., "*A Particle-Tracking Algorithm for the Multidomain Staggered-Grid Spectral Method*", AIAA Paper 2001-0630, 2001.

Other Conference Papers and Abstracts

1. Jacobs, G.B., "*Inertial Particle Behavior in Unsteady Separated Flow*", APS Division of Fluid Dynamics 60th Annual Meeting, Salt Lake City, UT, Nov. 2007.
2. Sengupta, K., Jacobs, G.B., Mashayek, F., "*Large Eddy Simulation Using a Multidomain Spectral Method*", APS Division of Fluid Dynamics 58th Annual Meeting, Salt Lake City, UT, Nov. 2007.
3. Kilic, M., Jacobs, G.B., Haller, G., "*Reduced Navier-Stokes Equations Near a Flow Boundary*", APS Division of Fluid Dynamics 58th Annual Meeting, Chicago, IL, Nov. 2005.
4. Jacobs, G.B., Hesthaven, J.S., "*Flexible High-Order Temporal Integration for High-Order Particle-In-Cell Methods*", ICOSAHOM 07, Beijing, China, June 2007.
5. Jacobs, G.B., Narayan, A., Hesthaven, J.S., "*Temporal and Spatial Adaptivity in High-Order Discontinuous Galerkin Particle-In-Cell Methods*", SIAM Annual Conference, Boston, MA, July 2006.
6. Jacobs, G.B., Mashayek, F., Kopriva, D.A., "*Turbulent Subsonic Particle-Laden Flow over an Open Backward-Facing Step With and Without Countercurrent Shear at $Re=3000$* ", APS Division of Fluid Dynamics 58th Annual Meeting, Chicago, IL, Nov. 2005.
7. Shah, P., Mashayek, F., Jacobs, G.B., "*Subsonic Compressible Flow in Two-Sided Lid-Driven Cavity*", APS Division of Fluid Dynamics 58th Annual Meeting, Chicago, IL, Nov. 2005.
8. Kilic, M., Jacobs, G.B., Haller, G., "*Reduced Navier-Stokes Equations Near a Flow Boundary*", APS Division of Fluid Dynamics 58th Annual Meeting, Chicago, IL, Nov. 2005.
9. Jacobs, G.B., Shotorban, B., Gao, Z., Pandya, R.V.R., Mashayek, F., "*Numerical Simulation of Controlled Liquid-Fuel Combustors*", Proceedings of the 16th ONR Propulsion Meeting, Los Angeles, CA, June, 2003.
10. Jacobs, G.B., Pandya, R.V.R., Shotorban, B., Gao, Z., Mashayek, F., "*Deterministic and Probabilistic Approaches for Prediction of Two-Phase Turbulent Flow in Liquid-Fuel Combustors*", Proceedings of the 15th ONR Propulsion Meeting, Washington, DC, August 5-7, 2002.
11. Mashayek, F., Pandya, R.V.R., Jacobs, G. B., Shotorban, B., "*A Review of State-of-the-Art Computational Techniques to Study Heterogeneous Mixing Relevant to Deflagration and Detonation*", International Colloquium on Advances in Confined Detonations, Moscow, Russia, July 2-5, 2002.
12. Jacobs, G.B., Mashayek, F., "*Droplet Dispersion in the Wake of a Square Cylinder at Low Reynolds Number*", The Proceedings of the 15th Annual Conference on Liquid Atomization and Spray Systems, Madison, WI, May 2002.

13. Jacobs, G.B., Pandya, R.V.R., Mashayek, F., "*Simulation and Modeling of Two-Phase Turbulent Flows for Prediction and Control of Combustion Systems*", The Proceedings of the 14th ONR Propulsion Meeting, Chicago, IL, August 8-10, 2001.
 14. Jacobs, G.B., Pandya, R.V.R., Mashayek, F., "*Simulation and Modeling of Two-Phase Turbulent Flows for Prediction and Control of Combustion Systems*", The Proceedings of the 13th ONR Propulsion Meeting, Minneapolis, MN, August 10-12, 2000.
-

Presentations

Invited Seminars

- 2008-2009** University of Southern California, AFRL Wright-Patterson
- 2006-2007** Computational Science Research Center (SDSU), UC San Diego, UC Irvine, UC Los Angeles, University of Twente, NASA Langley, General Atomics.
- 2005-2006** Clemson University, University of Connecticut, University of Waterloo, Wright State University, San Diego State University, University of Texas at El Paso, University of Colorado at Denver.
- 2004-2005** Massachusetts Institute of Technology, Los Alamos National Laboratory, University of Illinois at Chicago.
- 2003-2004** Brown University.

Conference

- 2009 Jan.** "*Inertial Particle Dispersion in the Lagrangian Wake of a Square Cylinder*", 47th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, FL.
- 2009 Jan.** "*Computation of Normal Shocks Running into a Cloud of Particles using a High-Order Particle-Source-in-Cell Method*", 47th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, FL.
- 2008 June** "*Effect of Flexibility on Part-Load Performance of a Wind Turbine Blade: an Aerodynamic Study*", ECOS 2008, Cracow, Poland.
- 2008 Jan.** "*Inertial Particle Behavior in a Separated, Turbulent Flow*", 46th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV.
- 2007 Nov.** "*Inertial Particle Behavior in Unsteady Separated Flow*", APS Division of Fluid Dynamics 60th Annual Meeting, Salt Lake City, UT.
- 2007 June** "*Flexible High-Order Temporal Integration for High-Order Particle-In-Cell Methods*", International Conference on Spectral and High-Order Methods (ICOSAHOM), Beijing, China.
- 2007 Jan.** "*Identification of Flow Separation in Three and Four Dimensions*", 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV.
- 2007 July** "*Temporal and Spatial Adaptivity in High-Order Discontinuous Galerkin Particle-In-Cell Methods*", SIAM Annual Meeting, Boston, MA.
- 2006 Jan.** "*Simulations of Plasmas with a High-Order Discontinuous Galerkin Particle-in-Cell Solver*", 44th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV.
- 2005 Nov.** "*Turbulent Subsonic Particle-Laden Flow over an Open Backward-Facing Step With and Without Countercurrent Shear at $Re=3000$* ", APS Division of Fluid Dynamics 58th Annual Meeting, Chicago, IL.

- 2004 June** *"High-Order Particle-In-Cell Methods"*, International Conference on Spectral and High-Order Methods (ICOSAHOM), Brown University, Providence, RI.
- 2003 Jan.** *"A Validation Study of a Multidomain Spectral Code for Simulation of Turbulent Flows"*, 42nd AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV.
- 2003 July** *"Compressibility Effects on the Subsonic Two-Phase Flow over a Square Cylinder"*, 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Indianapolis, IN.
- 2002 May** *"Droplet Dispersion in the Wake of a Square Cylinder at Low Reynolds Number"*, 15th Annual Conference on Liquid Atomization and Spray Systems, Madison, WI.
- 2001 Jan.** *"A Particle-Tracking Algorithm for the Multidomain Staggered-Grid Spectral Method"*, 40th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV.
-

Awards, Memberships

Awards

- 2008 Outstanding Faculty Award.
- Who's Who in Science and Engineering, 2005-present.
- Who's Who in America, 2007-present.
- Who's Who in the World 2006-present.
- University Fellowship, University of Illinois at Chicago, 2002.
- Provost's Award for Graduate Research, University of Illinois at Chicago, 2001.
- Honor Propaedeuse, Delft University of Technology, 1994.

Memberships

- 2001-present, Member of the American Institute for Aeronautics and Astronautics.
 - 2005-present, Member of the American Physical Society.
 - 2007-present, Member of the American Society for Engineering Education
-

Service

University Services

- Judge for the Student Research Symposium, SDSU, March 1, 2008.

College of Engineering Services

- Computer Policy Committee, Spring 2007-present.

Departmental Services

- Faculty Hiring Committee, Fall 2007-Spring 2008.
- Chair of the Web Page Committee, Spring 2007-present.
- Advisor for Sigma Gamma Tau, National Honor Society in Aerospace Engineering, Fall 2008-present.

Thesis/Dissertation Committees Served

- Mary Thomas, Ph.D., Computational Science, SDSU (Advisor: Castillo), 2008.
- Kristen Armstrong, AE & EM (Advisor: Self), Spring 2008.
- Abhishek Singh, M.S., EE (Advisor: Sharma), Spring 2008.
- Laurie Gris, M.S., AE & EM (Advisor: Katz), Fall 2007.
- Richard Harris, M.S., ME (Advisor: Impelluso), Spring 2007.
- Zaid Karim, ME (Advisor: Bhattacharjee), Fall 2006.

Sessions Chaired and Organized

- Session Chair, "Turbulence Simulations II", 60th Annual Meeting of the Division of Fluid Dynamics of the American Physical Society, Salt Lake City, UT, Nov. 19, 2007.
- Session Chair, "Heterogeneous Flow in Energy Systems", 45th Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 10, 2007.
- Organization of Minisymposium, "Advances in Particle-Particle and Particle-Mesh Algorithms", SIAM Annual Meeting, Boston, MA, July 12-13, 2006.

Referee/Reviewer

- Academic Press
- Aerospace Science and Technology
- AIAA Journal
- Computers and Fluids
- Communications in Computational Physics
- ETNA Journal
- International Journal for Numerical Methods in Fluids
- Journal of Aerosol Science
- Journal of Computational and Applied Mathematics
- Journal of Computational Physics
- Journal of Engineering Mathematics
- Journal of Scientific Computing
- Microfluids and Nanofluids
- Numerical Heat Transfer
- Theoretical and Computational Fluid Dynamics
- Taylor and Francis

Professional Activities

- Scientific Committee Member, Conference on Finite Element Methods in Engineering and Science, FEMTEC, 2009.
 - Member, American Institute for Aeronautics and Astronautics Technical Committee on Terrestrial Energy Systems, 2007-present.
-

Teaching and Advising

Courses Taught

At San Diego State University

- Viscous Fluid Flow (AE550), Fall 2008.
- Aircraft Propulsion Systems (AE430), Fall 2007, Fall 2008.
- High-Speed Aerodynamics (AE302), Spring 2007, Spring 2008.
- Computational Fluid Dynamics (AE601), Fall 2006, Fall 2007.

At Brown University

- Introduction to Numerical Analysis (AM118), Brown University, Spring 2005.

Advising

Graduate Students Advised: Current Students

- Vaishali Amin (June 2007-present), Ph.D. Candidate, Joint Doctoral Program between San Diego State University and the University of California at San Diego.
- Kaustav Sengupta (Jan. 2005-present), Co-Advisor (Advisor: Farzad Mashayek), Ph.D. Candidate, Mechanical Engineering, University of Illinois at Chicago. Thesis: High-Fidelity DNS and LES of Non-Homogeneous Turbulent Flows. Expected: June 2009.
- Thomas Dittmann (June 2008-present), M.S. Student.
- Brian Gaston (June 2007-present), M.S. Student.

Graduate Students Advised: Former Students

- Kristen Armstrong (2007-2008), M.S. Degree in Aerospace Engineering, San Diego State University. Thesis: How Does Inertial Particle Dispersion Relate to the Finite Time Lyapunov Exponent in a Vortex Dominated Wake?
- Akil Narayan (2004-2006), Co-Advisor (Advisor: Jan Hesthaven), Ph.D. Candidate in Applied Mathematics, Brown University.
- Palak Shah (2002-2003), Co-Advisor (Advisor: Farzad Mashayek), M.S. Degree in Mechanical Engineering, University of Illinois at Chicago. Thesis: Numerical Investigation of Compressible Flow in Two-Sided Lid-Driven Cavity.

Undergraduate Students Advised

- Ian Grado, "Preliminary Design of a Flexible Wind Turbine Blade", Spring 2008.
- Philip Lee, "Preliminary Design of a Flexible Wind Turbine Blade", Spring 2008.
- Brice Ambrecht, "Preliminary Design of a Flexible Wind Turbine Blade", Fall 2007.
- Sergio Hernandez, "Preliminary Design of a Flexible Wind Turbine Blade", Fall 2007.
- Chad Smith, "Shock-Boundary Layer Interaction in the Flow over a Sinusoidal Wall", Fall 2006-Spring 2007.
- Brian Gaston, "RANS Simulations of the Flow over a Wall-Mounted Hump", Fall 2006-Spring 2007.

International Interns Advised

- Marc Bouffanais, "Analysis of Fixed and Moving Separation in Rotor-Oscillator Flow", Universite Pierre et Marie Curie, Paris VI, France, Summer 2008.

- Eelco Hoogendoorn, "Effect of Flexibility on Part-Load Performance of a Wind Turbine Blade: an Aerodynamic Study", University of Twente, The Netherlands, Fall 2007.
- Stephane Silvi, "Particle-Laden Flow Computation with a Force-Coupling Method", l'Institut Francais de Mechanique Avancee, France, Spring 2007.
- Yoram Levy, "CFD Simulations of Compressible Flows in a Diffuser", Universite Pierre et Marie Curie , Paris VI, France, Spring 2007.

Teaching Details: <http://attila.sdsu.edu/jacobs/teaching.html>
