**BIOGRAPHICAL SKETCH AND PROFESSIONAL ACTIVITIES**
**University of Colorado at Boulder**

**I.** **Name:** Kenneth E. Jansen
**Current Rank:** Full Professor
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**School:** Engineering
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## Educational Preparation

9/93 Ph.D. in Mechanical Engineering, Division of Applied Mechanics, with minor in Aeronautics and Astronautics, Stanford University, Stanford, CA.
6/88 M.S. in Mechanical Engineering, Stanford University, Stanford, CA.
5/87 B.S. in Mechanical Engineering, University of Missouri-Columbia, Columbia, MO.

## II. Professional Experience

1/10-present *Full Professor*, Department of Aerospace Engineering Sciences. Joint appointment to Department of Computer Science. University of Colorado, Boulder.

12/07-1/10 *Full Professor*, Department of Mechanical, Aerospace and Nuclear Engineering, with joint appointments in Biomedical Engineering, Computer Science and in Information Technology, Rensselaer Polytechnic Institute

12/01-12/07 *Associate Professor*, Department of Mechanical, Aeronautical and Nuclear Engineering, with joint appointments in Biomedical Engineering, Computer Science and in Information Technology, Rensselaer Polytechnic Institute

8/96-12/01 *Assistant Professor*, Department of Mechanical Engineering with joint appointments in Computer Science (2001) and in Information Technology (1998), Rensselaer Polytechnic Institute

9/93-8/96 *Post-doctoral Fellowship*, Center for Turbulence Research, NASA Ames/Stanford University. Large-eddy simulation utilizing unstructured-grid finite element methods.

8/88-9/93 *Research Assistant*, Stanford University, Dissertation research: Reynolds-averaged Navier-Stokes equations modeling with the finite element method.

9/92-6/93 *Course Assistant*, (Finite Element Methods in Fluid Mechanics, graduate level), Stanford University.

5/87-9/87 and 6/88-9/88 *Summer Internship*, McDonnell Douglas Aerospace Corporation, St. Louis, MO.

## III. Honors and Awards

"Most Comprehensive Flow Visualization Animation", AIAA CFD Flow Visualization Event, AIAA-AVIATION17, "Interaction of a Synthetic Jet Actuator on a Separated Flow Over a Vertical Tail", Jansen, K.E., Rasquin, M. Farnsworth, J.A., Rathay, N., Mastriano, M., Amitay, M, associated with paper AIAA-3243.

AIAA Associate Fellow 2011

Boeing Supplier of the Year 2011 in the technology category (1 per year, given to RPI based collaborating work)

Rensselaer School of Engineering Faculty Research Award 2009

Young Investigator Award from the International Association for Computational Mechanics, September 2004.

The Lewis T. Assini Undergraduate Teaching and Counseling Award from the Department of Mechanical, Aerospace and Nuclear Engineering at Rensselaer Polytechnic Institute, May 2004.

National Science Foundation CAREER Award awarded on 2/1/00.

R.H. Gallagher Young Investigator Award from the United States Association of Computational Mechanics for 2001.

Scientific Program Committee for the Seventh and Eighth U.S. National Congress on Computational Mechanics 7/03 and 7/05.

Scientific Committee Member for the First and Second AFOSR International Conference on Direct Numerical Simulation and Large Eddy Simulation, 8/97 and 6/99.

Office of Naval Research Graduate Student Fellowship (8/87-1/91).

National Science Foundation Graduate Student Fellowship (8/87 declined to accept ONR).

## IV. Teaching

### A. Course

Fall 2008 MANE-4070-01 Aerodynamics, Enrollment: 118
Evaluation IDEA: Overall Course NA Instructor NA

Spring 2008 MANE-6720-01 Computational Fluid Dynamics. Enrollment: 18
Evaluation IDEA: Overall Course 3.6/5.0 Instructor 4.3/5.0

Fall 2007 MANE-4070-01 Aerodynamics, Enrollment: 94
Evaluation IDEA: Overall Course 4.2/5.0 Instructor 4.5/5.0

Spring 2007 ENGR-2250-01 Thermal Fluids I. Enrollment: 70
Evaluation IDEA: Overall Course 4.1/5.0 Instructor 4.4/5.0

Fall 2006 ENGR-1100-9 Introduction to Engineering Analysis, Enrollment: 71
Evaluation IDEA: Overall Course 3.8/5.0 Instructor 4.7/5.0

Fall 2006 ENGR-1100-10 Introduction to Engineering Analysis, Enrollment: 69
Evaluation IDEA: Overall Course 4.1/5.0 Instructor 4.9/5.0

Spring 2005 MANE-6720-01 Computational Fluid Dynamics. Enrollment: 20
Evaluation IDEA: Overall Course 4.0/5.0 Instructor 4.1/5.0

Fall 2005 MANE-4070-01 Aerodynamics, Enrollment: 76
Evaluation IDEA: Overall Course 4.0/5.0 Instructor 4.4/5.0

Spring 2005 ENGR-2250-01 Thermal Fluids I. Enrollment: 48
Evaluation IDEA: Overall Course 3.5/5.0 Instructor 4.3/5.0

Fall 2004 MANE-4070-01 Aerodynamics, Enrollment: 63
Evaluation IDEA: Overall Course 4.7/5.0 Instructor 4.5/5.0

Spring 2004 MEAE-6720-01 Computational Fluid Dynamics. Enrollment: 20
Evaluation IDEA: Overall Course 4.1/5.0 Instructor 4.4/5.0

Fall 2003 MANE-4070-01 Aerodynamics, Enrollment: 53
Evaluation IDEA: Overall Course 4.0/5.0 Instructor 4.0/5.0

Spring 2003 MEAE-6965 Turbulence Modeling Enrollment: 12
Evaluation IDEA: Overall Course 4.3/5.0 Instructor 4.4/5.0

Fall 2002 MANE-4070-01 Aerodynamics, Enrollment: 73
Evaluation IDEA: Overall Course 3.7/5.0 Instructor 4.0/5.0

Spring 2002 MEAE-6720-01 Computational Fluid Dynamics. Enrollment: 15&16
Evaluation IDEA: Overall Course 4.6/5.0 Instructor 4.6/5.0

Fall 2001 ENGR-1100-10 Introduction to Engineering Analysis, Enrollment: 58
Evaluation IDEA: Overall Course 4.1/5.0 Instructor 4.7/5.0

Spring 2001 MEAE -6760 Finite Element Methods for Fluid Dynamics, Enrollment: 11
Evaluation IDEA: Overall Course (NA) Instructor (NA)

Fall 2000 ENGR-1100-6 Introduction to Engineering Analysis, Enrollment: 50
Evaluation IDEA: Overall Course 4.1/5.0 Instructor 4.9/5.0

Spring-00 MEAE-6720-01&02 Computational Fluid Dynamics. Enrollment: 15&16
Evaluation IDEA: Overall Course 4.9/5.0 Instructor 4.8/5.0

Fall 1999 ENGR-1100-10 Introduction to Engineering Analysis, Enrollment: 58
Evaluation IDEA: Overall Course 3.7/5.0 Instructor 4.3/5.0

Spring 1999 MEAE -6760 Finite Element Methods for Fluid Dynamics, Enrollment: 9
Evaluation IDEA: Overall Course 4.6/5.0 Instructor 4.7/5.0

Fall 1998 ENGR-1100-05 Introduction to Engineering Analysis, Enrollment: 48
Evaluation Tau Beta Pi: Course: 3.3/4.0 Instructor: 3.9/4.0

Fall 1998 ENGR-1100-06 Introduction to Engineering Analysis, Enrollment: 44
Evaluation Tau Beta Pi: Course: 3.4/4.0 Instructor: 3.7/4.0

Spring-98 37-6720 Computational Fluid Dynamics. Enrollment: 20
Evaluation Tau Beta Pi: Course 3.6/4.0 Instructor: 3.7/4.0

Fall 1997 20-2400 Fluid Mechanics I, Enrollment: 44
Evaluation Tau Beta Pi: Course: 3.2/4.0 Instructor: 3.4/4.0

Fall 1997 37-4962 Aero Structures, Enrollment: 29
Evaluation Tau Beta Pi: Course 3.2/4.0 Instructor: 3.6/4.0

Spring 1997 37-6963 Finite Elements in Fluid Dynamics, Enrollment: 16
Evaluation Tau Beta Pi: Course: 3.1/4.0 Instructor: 3.4/4.0

Fall 1996 37-4962 Design and Analysis of Composite Structures, Enrollment: 23
Evaluation Tau Beta Pi: Course: 2.8 /4.0 Instructor: 3.1/4.0

Undergraduate Research Project Supervision (10 Students) Developed tools for simulation and animation of complex 3D flows. Animations used in teaching and research.

**B. Student Thesis Supervision**

**Thesis Completed – Masters**

David Pope, "Implementing a Loosely Coupled Fluid Structure Interaction Finite Element Model in PHASTA" (2015)

Nicholas Mati, "Numerical Investigation of Subsonic Flow through an Aggressive Flat Bottom Diffuser" (2014)

Jeff Martin, "Numerical Analysis of Synthetic Jet Flow Control on a Vertical Tail" (2012)

John A. Evans, "Multiscale and Stabilized Methods for Steady Fourth Order Problems in Fluid Dynamics" (2006)

Onkar Sahni, "An Anisotropic Adaptive Procedure for Efficient Blood Flow Simulations" (2004) (Co-advised with Shephard)

Fatih Uygar Danacioglu, "A New Matrix of Intrinsic Time Scales for Advection-Diffusion Systems" (2003)

Dave Corson, "Prediction of Complex 3-Dimensional Flows Using the $k$-$\varepsilon$-$v^2$ Turbulence Model" (2002)

Michael Yaworski, "Performance of Near-Wall Modeling Techniques in Reynolds-Averaged Navier Stokes Simulations" (2001)

Jurijs Bazilevs, "Comparison of Equal and Mixed-order Stabilized FEM Formulations for Incompressible Flow" (2001)

Dali Wang, "Investigation of Reynolds Averaged Mean Values and Fluctuations of Turbulent Flows in Liquid Encapsulated Czochralski (LEC) Crystal Growth Systems" (2001)

Anil Karanam, "Hierarchical Hexahedral Elements for Fluid Dynamics Simulations Using Stabilized Finite Element Methods" (2000)

Panagiotas Lapatas, "Effect of Mixed Element Topology with Hierarchical Basis on Computational Fluid Dynamics Solutions" (2000)

Saurabh S.Tendulkar, "A Performance Analysis of Sparse Iterative Linear Solvers for the Compressible Navier-Stokes Equations" (1999)

**Thesis Supervisor – Masters**

Benjamin Wright (RPI)
Benjamin Matthews (UCB) - Computer Science

**Thesis Completed – Doctoral**

Kyle Woolwine "Reduced Order Model of an External Compression Supersonic Engine Inlet" (2016)
Kedar Chitale, "Anisotropic Mesh Adaptivity for Turbulent Flows with Boundary Layers" (2013)

Yi Chen, “Subsonic Flows through S-Ducts with Flow Control” (2012)

Farhad Behafarid, “Multi-Scale, Multi-Physics Simulation of Gas Injection into the Liquid Using DNS/Level Set Method” (2012)

Victor Marrero,” Non-Newtonian Studies of Patient-Based Cardiovascular Models Using a Stabilized Finite Element Flowsolver” (2010)

Joseph Rodriguez, “Numerical Simulation of Two-Phase Annular Flow” (2010)

Min Zhou, “Petascale Adaptive Computational Fluid Dynamics” (2010)

Igor Bolotnov, “Cascade Modeling of Single and Two-Phase Turbulence” (2008) (co-advised with R.T. Lahey)

Chun Sun, “Parallel Algebraic Multigrid for the Pressure Poisson Equation in a Finite Element Navier-Stokes Solver” (2008)

Anil Kumar Karanam, “A P-adaptive Stabilized Finite Element Method for Fluid Dynamics” (2008)

Guillermo Araya “DNS of Turbulent Heat Transfer in Wall Bounded Flows” (2008) (co-advised with L.Castillo)

Onkar Sahni, “Automated Adaptive Viscous Flow Simulations” (2007) (co-advised with M.S. Shephard)

Azat Galimov, “An Analysis of Interfacial Waves and Air Ingestion Mechanisms” (2007) (co-advised with R.T. Lahey)

Irene E. Vignon-Clementel, “A Coupled Multidomain Method for Computational Modeling of Blood Flow”, (2006) (co-advised with C.A. Taylor at Stanford University)

C. Alberto Figueroa, “A Coupled-Momentum Method to Model Blood Flow and Vessel Deformation in Human Arteries: Applications in Disease Research and Simulation-Based Medical Planning”, (2006) (co-advised with C.A. Taylor at Stanford University)

Elaine Bohr, “Inflow Generation Technique for Large Eddy Simulation of Turbulent Boundary Layers”, (2005)

Sunitha Nagrath, “Adaptive Stabilized Finite Element Analysis of Multi-phase Flows using a Level Set Approach” (2004)

Juin Kim, “Studies of Non-Newtonian Fluid Flows with a Stabilized Finite Element Method” (2003)

Andres Tejada-Martinez, "Dynamic Subgrid-Scale Modeling in Large-Eddy Simulation of Turbulent Flows with a Stabilized Finite Element Method" (2002)

Je-Hoon Kim, "Fin Shape Effects in Turbulent Heat Transfer in Tubes with Helical Fins" (2000) (co-advised with M. Jensen)

Christian H. Whiting, "Stabilized Finite Element Methods for Fluid Dynamics Using a Hierarchic Basis" (1999)

**Thesis Supervisor - Doctoral**

Meredith Ward
Ryan Skinner
Riccardo Balin
Felix Newberry (joint with Alireza Doostan).

**Thesis Committee Member**

Viswanath Ramakkagari (RPI)
Emilie Marchandise (Univeritie Catholic Louvain, Belgium)
Anne Amblard (I.N.S.A. de Lyon, France)
Xiarong Li (RPI)
Rob Lotz (RPI)
Yong Qu (RPI)
Thomas Giddings (RPI)
Takumi Hawa (RPI)
Rao Garimella (RPI)
Xiaoyue Liu (RPI)
Mustafa Dindar (RPI)
Zhen Wang (RPI)
Ting Xie (RPI)
Xiaoqing Ge (RPI)
Aleksandr Ovcharenko (RPI)
Kevin Basore
Tim Jung
Scott Waggy
Charles Woods
Tara Gallaway (RPI)
Jing Fu (RPI) Christopher Cooley
Eric Peters
Ethan Culler
Joseph Straccia
Luke Engvall

### C. Course and Curriculum Development

MEAE-6965 Turbulence Modeling was a completely new course.
MEAE-6963 Finite Elements in Fluid Dynamics was a completely new course.
MEAE-6720 Computational Fluid Dynamics was a significant overhaul of existing course in catalog.
ENGR-1100 Introduction to Engineering Analysis: assisted in conversion from traditional delivery to current laptop/studio delivery.

## V. Publications

### A. Books, Monographs, Recordings, Large Scale Musical or Video Works, Commissions

1. Exascale Scientific Applications: Scalability and Performance Portability, CRC Press, JANSEN KE, Rasquin M, Brown J, Smith C, Shephard MS, Carothers C. "Chapter 15 Extreme Scale Unstructured Adaptive CFD for Aerodynamic Flow Control." Ed.Straatsma TP; Antypas KB; Williams TJ. (November 13, 2017).
2. Direct and Large-Eddy Simulation IX, Springer, Dechamps, X, Rasquin, M, Jansen, KE, and Degrez, G, (Contributed a Chapter entitled "Numerical Study of Turbulent Pipe Flow with Transverse Magnetic Field Using a Spectral/Finite Element Solver"), Ed. Frohlich, J, Springer, (2015).
3. Finite Element Methods, 1970's and Beyond, L.P. Franca Ed. CIMNE, Barcelona, Spain (2004) (Contributed a Chapter entitled "A Look at Turbulence from the Finite Element Perspective").
4. Finite Element Flow Simulation, Takashi Nomura Ed., Springer-Verlag Tokyo, Japan, 1998, (Contributing author of Chapter 7 with Hughes, TJR, Johan, Z, and Hauke, G.)
5. Computational Nonlinear Mechanics in Aerospace Engineering, (ed. S.N. Atluri), AIAA, Washington D.C. (1992), (Contributing author of Chapter 5, ``Fast projection algorithm for unstructured meshes" with Shakib, F, and Hughes, TJR)

### B. Journal Articles

1. Farnsworth, J.A., Rathay, N, Rasquin, M, Jansen, KE, and Amitay, M, "Interaction of a Synthetic Jet Actuator with a Severely Separated Crossflow", *JOURNAL OF FLUID MECHANICS,* (final editing) (2019).
2. Jun Fang, Joseph J. Cambareri, Michel Rasquin, Andre Gouws, Ramesh Balakrishnan, Kenneth E. Jansen & Igor A. Bolotnov (2019) Interface Tracking Investigation of Geometric Effects on the Bubbly Flow in PWR Subchannels, Nuclear Science and Engineering, 193:1-2, 46-62, DOI: 10.1080/00295639.2018.1499280
3. Woolwine, KJ, Jansen, KE, Kopasakis, G, and Connolly, JW, "Reduced Order Modeling of a Supersonic Flow Field", *AIAA Journal of Propulsion and Power*, accepted (2018) 10.2514/1.B37064.
4. Rasquin, M, Rathay, N, Amitay, M, and Jansen, KE, "Interactions of an Array of Synthetic Jet Actuators with a Severely Separated Crossflow", *JOURNAL OF FLUID MECHANICS,*

(in preparation) (2019).

5. Jansen, K.E., Rasquin, M. Farnsworth, J.A., Rathay, N., Mastriano, M., Amitay, M., "Interaction of a Synthetic Jet Actuator on Separated Flow over a Vertical Tail", *AIAA Journal,* **56**, 7, pp.2653—266*8,* (2018).
6. Rasquin, M., Farnsworth, J.A, Balin, R. and Jansen, K.E., "Modeling Strategies of Active Flow Control Applied to a Vertical Tail Assembly", *AIAA Journal*, (in preparation) 2019.
7. Rasquin, M, Marion, P, Vishwanath, V, Matthews, B, Loy, RM, Zhou, M, Sahni, O, Carothers, CD, Shephard, MS, Hereld, M, Papka, ME, Kumaran, K, Geveci, B, and Jansen, KE, "Co-Visualization of Full Data and In Situ Data Extracts from Unstructured Grid CFD", *Computing and Visualization in Science*; (in preparation) (2019).
8. Balin, R., Rasquin, M., Chitale, K., and Jansen, K.E., "Investigation into the Performance of Turbulence Models for the Computation of High-Lift Flows at Large Angles of Attack", (in preparation) AIAA Journal (2019).
9. Skinner, R, Rasquin, M, and Jansen, KE, "A Comparison of Turbulence Models for the Simulation of Adverse Pressure Gradient Flow Control via Unsteady Tangential Blowing", *Computers & Fluids*, (in preparation**)** (2019).
10. Skinner, R., Doostan, A., Peters, E., Evans, J.A., and Jansen, K.E., "A Reduced-Basis Multi-Fidelity Approach for an Efficient Parametric Study of NACA Airfoils", AIAA Journal, (in press) (2018).
11. Smith, C.W., Rasquin, M., Ibanez, D. Jansen, K.E., and Shephard M.S. "Improving unstructured mesh partitions for multiple criteria using mesh adjacencies." *SIAM Journal on Scientific Computing* ,40, 1, pp.47-75, (2018).
12. Smith, C.W., Granzow, B, Diamond, G., Ibanez, D. Sahni, O., Jansen, K.E., and Shephard, M.S. "In-memory integration of existing software components for parallel adaptive unstructured mesh workflows." *Concurrency and Computation: Practice and Experience* **30** 18 (2018) doi:10.1002/cpe.4510 ,
13. Doosttalab, A, Araya, G, Newman, J, Adrian, RJ, Jansen, KE, Castillo, L, "Effect of small roughness elements on thermal statistics of a turbulent boundary layer at moderate Reynolds number", *JOURNAL OF FLUID MECHANICS*, 787 (January 01, 2016): 84-115.
14. Sahni O, Ovcharenko A, Chitale KC, Jansen KE, Shephard MS. "Parallel anisotropic mesh adaptation with boundary layers for automated viscous flow simulations." *Engineering with Computers*. 33 (4) (2016): 767-795.
15. Behafarid, F, Jansen, KE, and Podowski, MZ, "A Study on Large Bubble Motion and Liquid Film in Vertical Pipes and Inclined Narrow Channels", *International Journal of Mulitphase Flow,* **75** (2015) 288-299.
16. Vaccaro, JC, Elimelech, Y, Chen, Y, Sahni, O, Jansen, KE, and Amitay, M, "Experimental and Numerical Investigation on Steady Blowing Flow Control within a Compact Inlet Duct", *International Journal of Heat and Fluid Flow*, **54** (2015) 143-152.
17. Marrero, VL, Tichy, JA, Sahni, O, and Jansen, KE, "Numerical Study of Purely Viscous Non-Newtonian Flow in an Abdominal Aortic Aneurysm." *Journal of biomechanical engineering* 136, no. 10 (2014).
18. Chitale, KC, Sahni, 0, Shephard, MS, Tendulkar, S, and Jansen, KE, "Anisotropic Adaptation for Transonic Flows with Turbulent Boundary Layers." *AIAA Journal,* **53,** No. 2, (2014): DOI: 10.2514/1.J053159.
19. Rasquin, M, Smith, CW, Chitale, K, Seol, SE, Matthews, B, Martin, J, Sahni, O, Loy, R, Shephard, MS, and Jansen, KE, "Scalable fully implicit flow solver for realistic wings with flow control." *Computing in Science and Engineering,* **16**, no. 6 (2014) 13-21.
20. Rodriguez, JM, Sahni, O, Lahey, RT, and Jansen, KE, "A parallel adaptive mesh method for the numerical simulation of multiphase flows", *Computers & Fluids*, **87**, (2013). pp. 115-131.

21. Vaccaro, JC, Elimelech, Y, Chen, Y, Sahni, O, Jansen, KE, and Amitay, M, "Experimental and numerical investigation on the flow field within a compact inlet duct", *International Journal of Heat and Fluid Flow*, **44**, (2013) pp. 478-488.
22. Cardillo, J, Chen, Y, Araya, G, Newman, J, Jansen, K, and Castillo, L, "DNS of a turbulent boundary layer with surface roughness", *JOURNAL OF FLUID MECHANICS* ,**729**:603-637 Aug 2013
23. Behafarid, F, Shaver, D, Bolotnov, IA, Antal, SP, Jansen, KE, and Podowski, MZ, "Coupled DNS/RANS Simulation of Fission Gas Discharge During Loss-of-Flow Accident in Generation IV Sodium Fast Reactor", *Nuclear Technology*, **181**, 1 (2013) pp. 44-55.
24. Wong, JSH, and Jansen, KE, "Residual Distribution Finite Element Method for Convection-Dominated Problems", *Computer Methods in Applied Mechanics and Engineering,* **245**, (2012) pp. 232-242
25. Bolotnov, IA, Antal, SP, Jansen, KE, and Podowski, MZ, "Multidimensional Analysis of Fission Gas Transport Following fuel Element Failure in Sodium Fast Reactor", *Nuclear Engineering and Design*, **247**, (2012) pp. 136-146.
26. Zhou, M, Xie, T, S. Seol, Shephard, MS, Sahni, O, Jansen, KE, "Tools to Support Mesh Adaptation on Massively Parallel Computers", *Engineering with Computers*, **28**, (2012), pp 287-301, DOI: 10.1007/s00366-011-0218-x
27. Ovcharenko, A, Sahni, O, Jansen, KE, Carothers, CD, and Shephard, MS, "Neighborhood Communication Paradigm to Increase Scalability in Large-Scale Dynamic Scientific Applications", *Parallel Computing*, **38**, 3 (2012), pp. 140–156
28. Zhou, M, Sahni, O, Xie, T, Shephard, MS, and Jansen, KE, "Unstructured Mesh Partition Improvement for Implicit Finite Element at Extreme Scale", Journal of Supercomputing, **59**, 3 (2012) pp.1218-1228, doi:10.1007/s11227-010-0521-0.
29. Bolotnov, IA, Jansen, KE, Drew, DA, Oberai, AA, Lahey Jr., RT, and Podowski, MZ, "Detached direct numerical simulations of two-phase bubbly channel flow", *International Journal of Multiphase* Flow, **37**, 6 (2011) pp. 647-659
30. Araya, G, Castillo, L, Meneveau, C, and Jansen, KE, "A dynamic multi-scale approach for turbulent inflow boundary conditions in spatially developing flows", *Journal of Fluid Mechanics*, **670** (2011) pp. 581-605.
31. Sahni, O, Wood, J, Jansen, KE, and Amitay, M, "Three-dimensional Interactions between a Finite-Span Synthetic Jet and a Cross Flow", *Journal of Fluid Mechanics*, **671** (2011) pp 254-287.
32. Liu, N, Fu, J, Carothers, CD, Sahni, O, Jansen, KE, Shephard, MS, "Massively Parallel I/O for Partitioned Solver Systems, *Parallel Processing Letters,* **20**, 4 (2010) 377-395.
33. Bolotnov, IA, Lahey Jr. RT, Drew, DA, Jansen, KE, and Oberai, AA, "Spectral analysis of turbulence based on the DNS of a channel flow", *Computers & Fluids*, **39**, 4 (2010) 640-655.
34. Kim, HJ, Vignon-Clementel, IE, Figueroa, CA, Jansen, KE, and Taylor, CA, "Developing computational methods for three-dimensional finite element simulations of coronary blood flow", *Finite Elements in Analysis and Design*, **46**, 6 (2010) 514-525.
35. Galimov, AY, Sahni, O, Lahey Jr., RT, Shephard, MS, Drew, DA and Jansen, KE, "Parallel Adaptive Simulation of a Plunging Liquid Jet", *Acta Mathematica Scientia*, **30**, 2 (2010) 522-538.
36. Kim, HJ, Jansen, KE, and Taylor, CA, "Incorporating Autoregulatory Mechanisms of the Cardiovascular System in Three-Dimensional Finite Element Models of Arterial Blood Flow", *Annals of Biomedical Engineering*, **38**, 7 (2010) 2314-2330.
37. Zhou, M, Sahni, O, Shephard, MS, Carothers, CD, Jansen, KE, "Adjacency-based Data Ordering Algorithm for Acceleration of Parallel Finite Element Computations", *Scientific Programming*, **18**, 2 (2010) 107-123.

38. Vignon-Clementel, IE, Figueroa, CA, Jansen, KE, and Taylor, CA, "Outflow boundary conditions for three-dimensional simulations of non-periodic blood flow and pressure fields in deformable arteries", *Computer Methods in Biomechanics and Biomedical Engineering*, **13**,5 (2010) 625-640.
39. Avila, RS, Zulueta, JJ, Shara, N, Jansen, KE, Veronesi, G, Wang, H, and Mulshine, JL, "A quantitative method for estimating individual lung cancer risk", *Academic Radiology,* **17**, 7 (2010) 830-840.
40. Kim, HJ, Vignon-Clementel, IE, Coogan, JS, Figueroa, CA, Jansen, KE, and Taylor, CA, "Patient-Specific Modeling of Blood Flow and Pressure in Human Coronary Arteries", *Annals of Biomedical Engineering*, **38**, 10 (2010) 3195-3209.
41. Zhou, M, Sahni, O, Kim, HJ, Figueroa, CA, Taylor, CA, Shephard, MS, and Jansen, KE, "Cardiovascular Flow Simulations at Extreme Scale", *Computational Mechanics*, **46**, 1 (2010) 71-82.
42. Zhou, M, Sahni, O, Devine, KD, Shephard, MS, and Jansen, KE, "Controlling Unstructured Mesh Partitions for Massively Parallel Simulations", *SIAM Journal on Scientific Computing*, **32**, 6 (2010) 3201-3227.
43. Sahni, O, Luo, XJ, Jansen, KE and Shephard, MS, "Curved boundary layer meshing for adaptive viscous flow simulation", *Finite Elements in Analysis and Design,* **46**, 1-2 (2010) 132-139.
44. Sahni, O, Carothers, C, Shephard, MS, Jansen, KE, "Strong scaling analysis of a parallel, unstructured implicit solver and the influence of the operating system interference", *Scientific Programming*, **17**, 3 (2009) 261-274.
45. Devine, K, Diachin, L, Kraftcheck, J, Jansen, KE, Leung, V, Luo, X, Miller, M, Ollivier-Gooch, C, Ovcharenko, A, Sahni, O, Shephard, MS, Tautges, T, Xie, T, and Zhou, M, "Interoperable mesh components for large-scale, distributed-memory simulations", *Journal of Physics: Conference Series*, **180**, 2009.
46. Vaccaro, J, Sahni, O, Olles, J, Jansen, KE, and Amitay, M, "Experimental and numerical investigations of active control of inlet ducts", *Journal of Flow Control*, **1**, 2 (2009) 133-154.
47. Bolotnov, IA, Lahey Jr, RT, Drew, DE, Jansen, KE, and Oberai, AA, "Spectral cascade modeling of turbulent flow in a channel", *Japanese Journal of Multiphase Flow*, **23**, 2 (2009) 190-204.
48. Araya, G, Jansen, KE, and Castillo, L, "Inlet condition generation for spatially developing turbulent boundary layers via multiscale similarity", *Journal of Turbulence*, **10**, 36 (2009).
49. Kim, HJ, Vignon-Clementel, IE, Figueroa, CA, LaDisa, JF, Jansen, KE, Feinstein, JA, and Taylor, CA, "On coupling a lumped parameter heart model and a three-dimensional finite element aorta model", *Annals of Biomedical Engineering,* **37**, 11 (2009) 2153-2169.
50. Kim, HJ, Figueroa, CA, Hughes, TJR, Jansen, KE, and Taylor, CA, "Augmented Lagrangian method for constraining the shape of velocity profiles at outlet boundaries for three-dimensional finite element simulations of blood flow", *Computer Methods in Applied Mechanics and Engineering*, **198**, 45-46 (2009), 3551-3566.
51. Trofima, AV, Tejada-Martinez, AE, Jansen, KE, and Lahey Jr, RT, "Direct numerical simulation of turbulent channel flows using a stabilized finite element method", *Computers and Fluids*, **38**, 4 (2009), 924-938.
52. Sahni, O, Jansen, KE, Taylor, CA, and Shephard, MS, "Automated adaptive cardiovascular flow simulations", *Engineering with Computers*, **25**, 1 (2009) 25-36.
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7. Jansen, KE, "Unstructured Grid Large Eddy Simulations of Flow Over an Airfoil", *Annual Research Briefs, Center for Turbulence Research, NASA Ames/Stanford University* (1994) 161-173.

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**E. Abstracts (reviewed)**

1. K.E. Jansen, J.A. Evans, A. Doostan, K. Maute, F. Newberry, and C. Nelson, (2018), "Immersive Simulation at Extreme Scale", *13th World Congress on Computational Mechanics*, July 22-27, New York, NY.
2. G. Araya, K.E. Jansen, (2018), "Hypersonic Spatially-developing Turbulent Boundary Layers via DNS", *13th World Congress on Computational Mechanics*, July 22-27, New York, NY.

3. R. Balin, E. Peters, J.E. Evans, P. Spalart, and K.E. Jansen, (2018), "Scale-Resolving Simulations of Turbulent Boundary Layers with Flow Separation", *13th World Congress on Computational Mechanics*, July 22-27, New York, NY.
4. J. Fang, R. Balin, M. Rasquin, R. Balakrishnan, and K.E. Jansen, (2018), "Adaptive DDES of a Vertical Tail/Rudder Assembly with Active Flow Control", *13th World Congress on Computational Mechanics*, July 22-27, New York, NY.
5. Jansen, KE and Rasquin, M, "Modeling Strategies of Active Flow Control Applied to a Realistic Wing Design", *Proceedings of the 13th US National Congress on Computational Mechanics*; Minneapolis, MN, USA; July 26-30, 2015.
6. Rasquin, M, Matthews, B, Smith, CW, Brown, J, and Jansen, KE, "Massively Parallel Flow Simulation Using PETSc", *Proceedings of the SIAM CS&E*, Salt Lake City, UT, March 15, 2015.
7. Chitale, K, Jansen, KE, Ovcharenko, A, Sahni, O, Shephard, MS, Tendulkar, S, Nastasia, R, and Beall, M, "Parallel Boundary Layer Mesh Adaptation at Large-Scale", *Proceedings of the 12$^{th}$ U.S. National Congress on Computational Mechanics*, Raleigh, NC, July 22-25, 2013.
8. Jansen, KE, "Stabilized Finite Element Methods for Turbulence", *Proceedings of the Advances in Computational Mechanics/FEF2013,* San Diego, Feb. 24-27, 2013.
9. Rasquin, M, Marion, P, Vishwanath, V, Matthews, B, Martin, J, Bauer, A, Sahni, O, Shephard, MS, Geveci, B, and Jansen, KE, "Live and Interactive Visualization of Turbulent Flows from a Massively Parallel Implicit CFD Simulation", *Proceedings of the Advances in Computational Mechanics/FEF2013,* San Diego, Feb. 24-27, 2013.
10. Chitale, K, Ovcharenko, A, Sahni, O, Shephard, MS, and Jansen, KE, "Parallel Anisotropic Adaptivity for Turbulent Flows with Boundary Layers", *Proceedings of the Advances in Computational Mechanics/FEF2013,* San Diego, Feb. 24-27, 2013.
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12. Rasquin, M, Sahni, O, and Jansen, KE, "Interaction between a finite-span synthetic jet and a cross flow over a swept wing", *11th US National Congress on Computational Mechanics*; Minneapolis, MN, USA; July 25-28, 2011.
13. Rasquin, M, Matthews, B, and Jansen, KE, "Workflow to support fast and big science with massively parallel implicit adaptive CFD simulation and live data visualization", *Proceedings of the World Congress on Computational Mechanics*, San Paulo, Brazil, July 2012.
14. Sun, C, Fish, J, Jansen, KE, and Waisman, H, "Parallel Algebraic Multigrid for the Incompressible Navier-Stokes Equations", *Proceedings of the 9$^{th}$ U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
15. Tejada-Martinez, AE, Jansen, KE, Lahey Jr, RT, and Trofimova, A, "Convergence Studies of Turbulent Channel Flows Using a Stabilized Finite Element Method", *Proceedings of the 9$^{th}$ U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
16. Jansen, KE, Sahni, O, Taylor, CA, "Turbulence in Abdominal Aorta Aneurysms", *Proceedings of the 9$^{th}$ U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
17. Kim, HJ, Figueroa, CA, Jansen, KE, Taylor, CA, and Vignon-Clementel, I, "Three-Dimensional Simulations of Aortic Blood Flow and Pressure Including a Lumped Heart Model", *Proceedings of the 9$^{th}$ U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.

18. Shephard, MS, FrantzDale, B, Jansen, KE, Luo, X, Nuggehally, M, Sahni, O, and Xie, T, "Next Steps in Supporting Parallel Adaptive Simulations", *Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
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20. Jansen, KE, Sahni, O, and Taylor, CA, "Turbulence in Cardiovascular Flows", *14th International Conference on Finite Elements in Flow Problems*, Santa Fe, New Mexico, March 26-28, 2007.
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22. Figueroa, CA, Vignon-Clementel, I, Jansen, KE, and Taylor, CA, "Large-scale Subject-specific Simulations of Blood Flow in Deformable Arteries using a Coupled-momentum Formulation", *Proceedings of the World Congress of Biomechanics*, Munich, Germany, July 29 - August 4, 2006. Journal of Biomechanics 2006; Vol. 39 Suppl. 1, page S441.
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25. Evans, J, Jansen, KE, Bohr, E, and Shephard, MS, "An explicit $C^1$ finite element for fluid dynamics applications", *Proceedings from the 7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
26. Mueller, J, Sahni, O, Jansen, KE, Shephard, MS, and Taylor, CA, "Adaptive anisotropic meshing of the cardiovascular system", *Proceedings from the 7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
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28. Figueroa, C, Vignon, I, Jansen, KE, and Taylor, CA, "The coupled-momentum method for fluid-structure interactions: Verification with Womersley elastic tube theory and applications to large-scale subject specific cardiovascular models", *Proceedings from the 7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
29. Jansen, KE and Taylor, CA, "Large eddy simulation in biomedical applications", *Proceedings from the 7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
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51. Hughes, TJR, Oberai, AA, and Jansen, KE, "Large Eddy Simulation and the Variational Multiscale Method," *Proceedings from 6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.
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53. Jansen, KE, "Variational Multiscale Methods for LES Using a Hierarchical Basis on Hexahedral or Tetrahedral Elements," *YES 2000: Workshop on Multiscale and Multiresolution Method*s, Oct. 2000, Yosemite, CA.
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**F. Abstracts (not reviewed)**

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2. R Balin, E Peters, J Evans, P Spalart, KE Jansen," Direct numerical simulation of a separated turbulent boundary layer over a bump" Bulletin of the American Physical Society, 2018.
3. J Fang, R Balin, M Rasquin, R Balakrishnan, KE. Jansen,"DDES Investigation of Aerodynamic Flow Control Efficiency over A Vertical Tail/Rudder Assembly" Bulletin of the American Physical Society, 2018

4. KE Jansen, J Fang, R Balin, M Rasquin, J Farnsworth, "Active Flow Control of Separation on a 1/19th and 1/9th Scale Vertical Tail", Bulletin of the American Physical Society, 2018
5. Skinner RW, J Gartner, M Amitay, JANSEN KE. "Modeling of Active Flow Control in an Aggressive Diffuser with Comparison to Experiment" Bulletin of the American Physical Society (APS-DFD) 2018.
6. Skinner RW, JANSEN KE. "Active Flow Control in an Aggressive Transonic Diffuser." Bulletin of the American Physical Society (APS-DFD) 2017.
7. JANSEN KE, Farnsworth J, Rasquin M, Rathay N, Monastero M, Amitay M. "Interaction of a Synthetic Jet Actuator with a Severely Separated Crossflow." Bulletin of the American Physical Society (APS-DFD, 2017): American Physical Society, 2017
8. Balin R, Spalart PR, JANSEN KE. "An investigation into the reduction of log-layer mismatch in wall-modeled LES with a hybrid RANS/LES approach." Bulletin of the American Physical Society (APS-DFD, 2017 - ), 2017
9. Araya JG, JANSEN KE. "Compressibility effect on thermal coherent structures in spatially-developing turbulent boundary layers via DNS." Bulletin of the American Physical Society (APS-DFD, 2017 - ): American Physical Society, 2017
10. Araya, G, Castillo, L, and Jansen, KE, "DNS of Stratified Spatially-Developing Turbulent Thermal Boundary Layers", *Bulletin of the American Physical Society: 65$^{th}$Annual Meeting of the APS Division of Fluid Dynamics*, **11,** 7 (2012).
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13. Rasquin, M, Mati, N, Sahni, O, and Jansen, KE, "Numerical investigation of the interaction between a finite-span synthetic jet and a cross flow over a swept wing", *Bulletin of the American Physical Society: 63$^{rd}$ Annual Meeting of the APS Division of Fluid Dynamics*, **15**, 16 (2010).
14. Wood, J, Amitay, M, and Jansen, KE, "Active flow control over a finite wing. Part 1: Experimental investigation", *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008.
15. Sahni, O, Amitay, M and Jansen, KE, "Active flow control over a finite wing. Part 2: Numerical investigation", *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008.
16. Araya, G, Castillo, L, Jansen, KE, and Meneveau, C, "A dynamic multi-scale approach for turbulent inflow generation in spatially developing boundary layers with streamwise pressure gradients", *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008.
17. Zhou, M, Figueroa, CA, Taylor, CA, Sahni, O, and Jansen, K, "Parallel adaptive computation of blood flow in a 3D "whole" body model", *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008
18. Marrero, V, Sahni, O, Tichy, JA, and Jansen, K, "Non-Newtonian study of blood flow in an abdominal aortic aneurysm with a stabilized finite element method", *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008
19. Sahni, O, Zhou, M, Jansen, KE, and Shephard, MS, "Fluid Dynamics Simulations on Massively Parallel Computers", *Proc. in 13th SIAM Conference on Parallel Processing for Scientific Computing*, Atlanta, GA, USA, Mar. 2008.

20. Jansen, KE, Ovcharenko, A, Sahni, O, Shephard, MS, Xie, T, and Zhou, M, "FMDB: Flexible Distributed Mesh Database for Parallel Automated Adaptive Analysis", *Proc. of the 13th SIAM Conference on Parallel Processing for Scientific Computing*, Atlanta, GA, USA, Mar. 2008.
21. Sahni, O, Jansen, KE, Shephard, MS, and Taylor, CA, "Adaptive Flow Simulation of Turbulence in Subject Specific Abdominal Aortic Aneurysm on Massively Parallel Computers", *Bulletin of the American Physical Society, 60th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2007 Salt Lake City, UT.
22. Sahni, O, Jansen, KE, and Shephard, MS, "Adaptive Anisotropic Meshing Control for Cardiovascular Flow Modeling", *2007 SIAM conference on Computational Science and Engineering,* Costa Mesa, CA.
23. Vignon, I, Figueroa, CA, LaDisa, J, Feinstein, JA, Jansen, KE, and Taylor, CA, "A variational multidomain method for solving the three-dimensional and one-dimensional equations of blood flow", *2005 SIAM Annual Meeting, New Orleans, LA*.
24. Figueroa, CA, Vignon, I, Jansen, KE, and Taylor, CA, "A computationally efficient method to simulate blood flow and vessel motion in three-dimensional arterial models", *2005 SIAM Annual Meeting, New Orleans, LA*.
25. Araya, G, Bohr, E, Jansen, KE, and Castillo, L, "Generation of Turbulent Inlet Conditions for thermal boundary layer simulation", *Bulletin of the American Physical Society, 58th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2005 Chicago, IL.
26. Marrero, VM and Jansen, KE, "Development of new boundary conditions for flow in human airways", *Bulletin of the American Physical Society, 58th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2005 Chicago, IL.
27. Bohr, E, Bailon-Cuba, J, Castillo, L, Jansen, KE, "Scaling Laws for Inflow Generation Techniques for Large Eddy Simulation of Turbulent Boundary Layers", *Bulletin of the American Physical Society, 57th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2004, Seattle, WA.
28. Mueller, J, Sahni, O, Jansen, KE, and Shephard, MS, "Anisotropic Mesh Adaptivity for FE-simulation of Cardiovascular Flow", *Bulletin of the American Physical Society, 57th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2004, Seattle, WA.
29. Bohr, E, Yaworski, M, and Jansen, KE, "Simulation of the Near-lip of a Jet", *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
30. Tejada-Martinez, AE and Jansen, KE, "A dynamic Smagorinsky model with dynamic determination of the filter width ratio", *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
31. Jansen, KE, Taylor, CA, and Mueller, J, "Flow Simulation to enable patient specific virtual surgical planning", *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
32. Nagrath, S, Jansen, KE, and Lahey Jr, RT, "Three dimensional simulation of incompressible two-phase flows using a stabilized finite element method and level set approaches", *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
33. Simmons, SP, Tejada-Martinez, AE, and Jansen, KE, "An application of variational multiscale methods using a hierarchical basis to compute turbulent flows", *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
34. Galimov, A, Nagrath, S, Moraga, F, Drew, D, Lahey Jr, RT, and Jansen, KE, "The development of interfacial drag and non-drag laws for stratified wavy flow using PHASTA-

2I", *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.

35. Jansen, KE, "The Effect of Element Topology on Variational Multiscale Methods for LES," *Bulletin of the American Physical Society, 53rd Annual Meeting of the Division of Fluid Dynamics*, Nov. 2000, Washington, DC.
36. Tejada-Martinez, AE and Jansen, KE, "Test Filters for Dynamic Model LES on Finite Elements", *Bulletin of the American Physical Society, 53rd Annual Meeting of the Division of Fluid Dynamics*, Nov. 2000, Washington, DC.
37. Bloomfield, MO, Jansen, KE, and Cale, TS, ``Multiscale Modeling of Electrochemical Deposition and Microloading Effects" *Proceedings of the198th Meeting of the Electrochemical Society,* October , 2000, Phoenix, AZ.
38. Jansen, KE, Hughes, TJR, and Whiting, CH, "A Variational Multiscale Method for LES," *Bulletin of the American Physical Society, 52rd Annual Meeting of the Division of Fluid Dynamics*, Nov. 1999, New Orleans, LA.
39. Jansen, KE, "Large Eddy Simulation of Airfoils Using Unstructured Grids", *Bulletin of the American Physical Society, 51st Annual Meeting of the Division of Fluid Dynamics*, Nov. 1998, Philadelphia, PA.
40. Whiting, C, and Jansen, KE, "Hierarchical Basis for Stabilized Finite Element Methods in Fluid Dynamics," *Bulletin of the American Physical Society, 51st Annual Meeting of the Division of Fluid Dynamics*, Nov. 1998, Philadelphia, PA.
41. Tejada-Martinez, A and Jansen, KE, "The Effect of Element Topology and Filter Type on the Dynamic Subgrid-Scale Model for Large-Eddy Simulation", *Bulletin of the American Physical Society, 51st Annual Meeting of the Division of Fluid Dynamics*, Nov. 1998, Philadelphia, PA.
42. Shi, G, and Jansen, KE, "New Boundary Conditions to Enable More Efficient Flow Simulation", *Bulletin of the American Physical Society, 51st Annual Meeting of the Division of Fluid Dynamics*, Nov. 1998, Philadelphia, PA.
43. Jansen, KE, "Large Eddy Simulation of Turbulent Flow Over A Cavity", *Bulletin of the American Physical Society, 50th Annual Meeting of the Division of Fluid Dynamics*, Nov. 1997, San Francisco, CA.
44. Jansen, KE, "Large Eddy Simulation of an Airfoil at Maximum Lift", *Bulletin of the American Physical Society, 49th Annual Meeting of the Division of Fluid Dynamics*, Nov. 1996, Syracuse, NY.
45. Jansen, KE, "Large Eddy Simulation Using Unstructured Grids," *Bulletin of the American Physical Society, 48th Annual Meeting of the Division of Fluid Dynamics*, Nov. 1995, Irvine, CA.

## VII. Editorship of Journals, Reviews of Manuscript, Book, Research Proposals, Curating and Jurying Exhibitions

*Editorial Board/Advisory Editor for:*
Computer Methods in Applied Mechanics and Engineering

*Frequent reviewer for:*
Computer Methods in Applied Mechanics and Engineering,
Theoretical and Computational Fluid Dynamics
Journal of Computational Physics.
AIAA Journal,

Physics of Fluids,
International Journal of Numerical Methods in Fluids,
Computational Mechanics,

*Less frequently:*
Thin Solid Films,
Journal of Crystal Growth.

*Recent Review Panels:*
NSF ITR-Medium (May 2004), CAREER 2005 (5), NSF Bio-Fluid Mechanics 2006 (7), NSF Track 2 Petascale Computer Acquisition (2008), NSF Teragrid.

*Proposal Reviews:*
DOE, NSF

## VIII. Service

### A. Service to University

#### 1. University, School, and Departmental Committees

**Departmental**

1. Aero Program Director (2007-present)
2. Rensselaer Medal Day (2005)
3. Served on two faculty search committees.
4. Y2K Department Coordinator, F98-2000.
5. Thermo-Fluids Committee since F96.
6. Aero Committee since F96.

**School**

1. Compensation Committee 2003
2. Associate Director of SCOREC
3. Diversity Planning Committee F00

**University**

1. Extensive effort toward determining the best configuration of the Computational Center for Nanotechnology Innovation (CCNI) (2006)
2. Capital Campaign Road Trip to San Jose, CA (Fundraising) 2/2005
3. Biotech Building GALA/Capital Campaign Kickoff: Developed and delivered one of only 3 featured research presentations at Gala Dinner (9/2004)
4. Presentations to Provost VIP's (4 times in 2003, 2 times in 2004, 2 time in 2005, 2 times in 2006)
5. Faculty Access to Research Information Committee 2005
6. Faculty Senate 1998-2000.

#### 2. Undergraduate Student Advising and Counseling

SoE Orientation for class of 2001, 2005, and 2009
Advising 29 from class of 2001, 32 from class of 2005, and 33 from 2009
Faculty Intervention Program (with the Advising and Learning Assistance Center).

#### 3. Non-thesis Graduate Student Advising and Counseling

Guangyu Shi, conferred M.Eng. 9/00

### B. Professional Societies

Supercomputing 2013, Technical Committee: Reviewed 8 papers then participated in 2 day panel to down-select and choose papers to be accepted.

SIAM Parallel Processing for Scientific Computing, conference session organizer (2 sessions in 2010 **Scaling Challenges in Massively Parallel Computing for Scientific Applications** and 3 sessions in 2012 **Challenges in Massively Parallel Simulations using Unstructured Meshes).**

United States Association for Computational Mechanics (Symposium Organizer and session chair)
Tau Beta Pi (Former Chapter President 1986-1987)
Pi Tau Sigma
American Society of Mechanical Engineers
American Physical Society (Session Chair)
American Institute of Aeronautics and Astronautics (Senior Member).
American Society of Civil Engineers (Computational Mechanics Technical Committee).

## IX. Professional and Public Lectures

### Invited

1. "Massively Parallel Simulation of Aerodynamic Flow Control", K.E.Jansen, CAUSE Distinguished Lecture, University of Puerto Rico Mayaguez, May, 8, 2017.
2. "DDES Applications to High-Lift and Active Flow Control", K. E. Jansen, *NASA Langley*, October 9 2015.
3. "An Introduction to the PHASTA Flow Solver", K. E. Jansen, *Boeing Webinar*, September 3, 2015.
4. "Massively Parallel Multiphase Flow Modeling with a Stabilized Finite Element Method", K. E. Jansen, Behafarid, F, J. Rodriguez, M. Podowski, Sahni, O, Lahey Jr., RT, Shephard, MS, *Keynote at the 11th US National Congress on Computational Mechanics*; Minneapolis, MN, USA; July 25-28, 2011.
5. "Interactive visualization strategies for a live unstructured grid CFD simulation at 160K cores of a Blue Gene/P supercomputer and 800 cores of an analysis cluster", Raquin, M, P. Marion, V. Vishwanath, B. Matthews, R. Loy, A. Bauer, Zhou, M, Sahni, O, Fu, J, N. Liu, Carothers, C, Shephard, M, M. Hereld, M. Papka, K. Kumaran, B. Geveci and Jansen, K, *Ecole Polytechnique Federale de Lausanne, Blue Brain Project*; Lausanne, Switzerland; 12 January 2012.
6. "A Comparison of In Situ Data Extraction versus Full Data Co-visualization at Full Machine Scale from a Live Unstructured Grid CFD Simulation", Raquin, M, P. Marion, V. Vishwanath, B. Matthews, R. Loy, A. Bauer, Zhou, M, Sahni, O, Fu, J, N. Liu, Carothers, C, Shephard, M, M. Hereld, M. Papka, K. Kumaran, B. Geveci and Jansen, K, *Ultrascale Visualization Workshop at the International Conference for High Performance Computing, Networking, Storage and Analysis*; Seattle, WS, USA; November 12-18, 2011.
7. "Adaptive Computational Fluid Dynamics: Petascale and Beyond", Jansen, KE, Sahni, O, A. Ovcharenko, M. S. Shephard M Zhou, SciDAC 2010, Chattanooga, TN.
8. "CFD, Hardware, and Scalability: Barriers, Challenges, and Opportunities", Jansen, KE, Keynote at ASME Ocean, Offshore, and Arctic Engineering (OMAE) ,June 2009
9. "Anisotropic, Adaptive, Implicit CFD", Jansen, KE, Science Track at Teragrid '09, June 2009.
10. "Petascale Adaptive Computational Fluid Dynamics", Jansen, KE, *Pathways to Blue Waters: Communication Intensive Algorithms and Applications,* Champaign, IL, October 2008.
11. "Toward Petascale Adaptive Computational Fluid Dynamics", Jansen, KE, *High Performance Computation Workshop: The role of high performance Computation in Economic Development,* Troy, NY, October 2008.
12. "Virtual Surgical Planning: Computing Blood flow within Real Patient Geometries", Jansen, KE, INSA LAMCOS Seminar Series, Lyon, France, November 2006.
13. Large Eddy Simulation with the Finite Element Method", Jansen, KE, *17th AIAA Computational Fluid Dynamics Conference,* Toronto, Ontario, CA, June 2005.
14. "A Look at Turbulence from the Finite Element Perspective", Jansen, KE, *A Conference Celebrating the 60th Birthday of Thomas J.R. Hughes,* Rice University, 2004.
15. "Computing Blood Flow within Real Patient Geometries", Jansen, KE, Shephard, MS, J. Mueller, Sahni, O, *At the ASME Heat Transfer Fluids Engineering Summer Conference,* Charlotte, NC, July 2004.
16. "Cardiovascular Flow Simulation", Jansen, KE, Shephard, MS, J. Mueller, Sahni, O, and Taylor, CA, *At the NSF Biotransport Process Workshop*, Arlington, VA, May 2004.
17. "A Comparison of the Accuracy and Efficiency of DG and SUPG Methods", Jansen, KE, Shephard, MS, and J.E. Flaherty, *16th AIAA Computational Fluid Dynamics Conference,* Orlando FL June 2003.

18. “Virtual Surgical Planning: Computing Blood Flow within Real Patient Geometries”, Jansen, KE, Clarkson Seminar Series, Sept. 2003.
19. “Variational Multiscale Models for LES on Unstructured Grids,” Jansen, KE, given at Centro Internazionale Matematico Estivo Course: Multiscale Problems and Methods in Numerical Simulations, Martina Franca, Italy, Sept. 9-15, 2001.
20. “LES with A Stabilized Finite Element Method,” Jansen, KE, given at General Electric Corporate Research and Development, Schenectady, NY, 5/99.
21. “Simulation Of Turbulent Flow Using Unstructured Grids,” Jansen, KE, given at Cornell Fluid Mechanics Colloquium, Ithaca, NY, 3/99.
22. “Computation of Turbulence with Stabilized Methods,” Jansen, KE, given at The Institute for Industrial Science, Tokyo, Japan, 4/98.
23. “Computation of Turbulence with Stabilized Methods,” Jansen, KE, given at 4th Japan-US Symposium on Finite Element Methods in Large Scale Computational Fluid Dynamics, Tokyo, Japan, 4/98.
24. “Computing Turbulence,” Jansen, KE, given at Rensselaer Polytechnic Institute Department of Mechanical Engineering, Aeronautical Engineering and Mechanics Colloquium, Troy, NY, 9/97.
25. “Large Eddy Simulation Using Unstructured Grids,” Jansen, KE, given at The First AFOSR International Conference on DNS/LES, Ruston, LA, 7/97.
26. “The Role of Entropy in Turbulence And Stabilized Finite Element Methods,” Jansen, KE, given at Centro Polytecnico Superior-Zaragoza Applied Math Colloquium, Zaragoza, Spain, 3/97.
27. “Computing Turbulence Using Finite Element Methods On Unstructured Grids,” Jansen, KE, given at Centro Polytecnico Superior-Zaragoza Applied Math Colloquium, Zaragoza, Spain, 3/97.

**Contributed**

1. Skinner RW, JANSEN KE. "Active Flow Control in an Aggressive Transonic Diffuser." Bulletin of the American Physical Society (APS-DFD, 2017), 2017
2. Araya, JG, Jansen, KE, “Effects of wall curvature on hypersonic turbulent spatially-developing boundary layers”, 2017 Annual Review for the AFOSR High Speed Aerodynamics Portfolio and the ONR Hypersonics Portfolio, July 24-27, 2017, NASA Langley Research Center, Hampton, Virginia.
3. Jansen KE, Farnsworth J, Rasquin M, Rathay N, Monastero M, Amitay M. "Interaction of a Synthetic Jet Actuator with a Severely Separated Crossflow." Bulletin of the American Physical Society (APS-DFD, 2017 - ): American Physical Society, 2017
4. Balin R, Spalart PR, JANSEN KE. "An investigation into the reduction of log-layer mismatch in wall-modeled LES with a hybrid RANS/LES approach." Bulletin of the American Physical Society (APS-DFD, 2017 - ), 2017
5. Araya JG, JANSEN KE. "Compressibility effect on thermal coherent structures in spatially-developing turbulent boundary layers via DNS." Bulletin of the American Physical Society (APS-DFD, 2017 - ): American Physical Society, 2017
6. Wurst, S, Balin R, Skinner, R, , JANSEN KE. "U. Colorado Contribution to HiLiftPW3." 3rd High Lift Prediction Workshop, Denver, CO, June3-4, 2017
7. Jansen, KE, Rasquin, M, Smith, CW, Matthews, B, “Extreme Scale Stabilized Finite Element Flow Simulations”, ECCOMAS Congress 2016, Crete, GR, June 6, 2016.
8. Jansen, KE, Kim, HJ, “Higher Order Stabilized Finite Element Methods for Cardiovascular Flow”, ECCOMAS Congress 2016, Crete, GR, June 7, 2016.

9. Jansen, KE, Brown, J, Rasquin, M, Matthews, B, Smith, CW, Ibanez, D, Shephard, MS, "Scaling Unstructured Mesh Computations", SIAM Parallel Processing, Paris, FR, April 14, 2016.
10. Jansen, KE, and Rasquin, M. "Modeling Strategies of Active Flow Control Applied to a Realistic Wing Design", *13th US National Congress on Computational Mechanics*; Minneapolis, MN, USA; July 26-30, 2015
11. Rasquin, M, B. Matthews, C.W. Smith, J. Brown, and Jansen, KE, "Massively Parallel Flow Simulation Using PETSc", SIAM CS&E, Salt Lake City, UT, March 15, 2015
12. Martin, D., Rasquin, M., Jansen, KE, "Demo of Adaptive Detached Eddy Simulation of a High-Lift Wing with Active Flow Control", NUFO Science Exposition, Washington, D.C., June (2014) (our ALCF INCITE project was selected as the live demonstration to congress and upper management of DOE of Argonne Leadership-Class Computing Facilities capabilities in simulation and visualization).
13. Chitale, KC, Rasquin, M, Sahni, O, Shephard, MS, and Jansen, KE, "Boundary Layer Adaptivity For Incompressible Turbulent Flows.", *World Congress of Computational Mechanics*, (2014).
14. Chitale, KC, Rasquin, M, Sahni, O, Shephard, MS, and Jansen, KE, "Anisotropic boundary layer adaptivity of multi-element wings". *52nd Aerospace Sciences Meeting* (2014).
15. Chitale, KC, Rasquin, M, Martin, J, and Jansen, KE, "Finite Element Flow Simulations of the EUROLIFT DLR-F11 High Lift Configuration", *52nd Aerospace Sciences Meeting* (2014).
16. Rasquin, M, Chitale, KC, Ali, M, and Jansen, KE, "Parallel Adaptive Detached Eddy Simulations of the EUROLIFT DLR-F11 High Lift Configuration", *32nd Applied Aerodynamics Conference,* (2014).
17. Raquin, M, Sahni, O, and Jansen, KE, "Interaction between a finite-span synthetic jet and a cross flow over a swept wing", *11th US National Congress on Computational Mechanics*; Minneapolis, MN, USA; July 25-28, 2011.
18. Raquin, M, N. Mati, Sahni, O, and K. E. Jansen, "Numerical investigation of the interaction between a finite-span synthetic jet and a cross flow over a swept wing", *63rd Annual Meeting of the American Physical Society, Division of Fluid Dynamics*, Long Beach, CA, USA; November 21-23, 2010.
19. Sahni, O, Jansen, KE, Shephard, MS and Zhou, M, Scalable Massively Parallel Implicit Simulations of Fluid Flows to over 250,000 Processor-cores, 2010 SIAM Conference on Parallel Processing for Scientific Computing, Seattle, WA, USA, Feb. 2010.
20. Zhou, M, Sahni, O, K.D. Devine, Shephard, MS, and Jansen, KE, Unstructured Mesh Partition Improvement for Implicit FE at Extreme Scale, SIAM PP 2010, Seattle, WA. Feb. 24-26, 2010.
21. "Active flow control over a finite wing. Part 1: Experimental investigation", J. Wood, Amitay, M, and Jansen, KE, *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008.
22. "Active flow control over a finite wing. Part 2: Numerical investigation", Sahni, O, Amitay, M, and Jansen, KE, *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008.
23. "A dynamic multi-scale approach for turbulent inflow generation in spatially developing boundary layers with streamwise pressure gradients", Araya, G, Castillo, L, K.E.. Jansen and C. Meneveau, *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008.
24. "Parallel adaptive computation of blood flow in a 3D "whole" body model", Zhou, M, C.A Figueroa, Taylor, CA, Sahni, O, and Jansen, K, *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008
25. "Non-Newtonian study of blood flow in an abdominal aortic aneurysm with a stabilizized finite element method", V. Marrero, Sahni, O, J.A. Tichy and Jansen, K, *Proc. in 61st Ann. Meeting of the Division of Fluid Dynamics of APS*, San Antonio, TX, USA, Nov. 2008

26. Tutorial on "Interoperable Mesh and Geometry Tools for Advanced Petascale Simulation", *SC08*, Austin, TX, Nov. 2008.
27. ITAPS+PHASTA project overview, Sahni, O, Jansen, KE, and Shephard, MS, *Workshop on Leadership-class Machines, Petascale Applications, and Performance Strategies*, Snowbird, UT, USA, July 2008.
28. "Petascale Computational Fluid Dynamics" Jansen, KE, Sahni, O, Shephard, MS, Carothers, C and A. Oberai, *Presentation and Panel at Petascale Workshop joint with Teragrid '08* meeting at LasVegas in June 2008.
29. "Fluid Dynamics Simulations on Massively Parallel Computers", Sahni, O, Zhou, M, K. E. Jansen and M. S. Shephard, *Proc. in 13th SIAM Conference on Parallel Processing for Scientific Computing*, Atlanta, GA, USA, Mar. 2008.
30. "FMDB: Flexible Distributed Mesh Database for Parallel Automated Adaptive Analysis", K. E. Jansen, A. Ovcharenko, Sahni, O, M. S. Shephard, Xie, T and Zhou, M, *Proc. in 2008 SIAM 13th Conference on Parallel Processing for Scientific Computing*, Atlanta, GA, USA, Mar. 2008.
31. "Numerical heat transfer analysis in turbulent wall bounded flows", Araya, G, Jansen, KE and Castillo, L, University of Karlsruhe, January 2008, Karlsruhe, Germany.
32. Mesh Control in the Adaptive Simulation of Cardiovascular Flows, Shephard, MS, Sahni, O and Jansen, KE, *Keynote Talk in 16th International Meshing Roundtable (IMR)*, Seattle, WA, USA, Oct. 2007.
33. "Adaptive Anisotropic Meshing Control for Cardiovascular Flow Modeling", Sahni, O, Jansen, KE, and Shephard, MS, 2007 *SIAM conference on Computational Science and Engineering,* Costa Mesa, CA.
34. "Parallel Algebraic Multigrid for the Incompressible Navier-Stokes Equations", C. Sun, J. Fish, Jansen, KE, H. Waisman, *Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
35. "Convergence Studies of Turbulent Channel Flows Using a Stabilized Finite Element Method", Tejada-Martinez, AE, Jansen, KE, Lahey Jr, RT, A. Trofimova,*Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
36. "Turbulence in Abdominal Aorta Aneurysms", Jansen, KE, Sahni, O, Taylor, CA, *Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
37. "Three-Dimensional Simulations of Aortic Blood Flow and Pressure Including a Lumped Heart Model", Kim, HJ, C.A. Figuroa, Jansen, KE, Taylor, CA, I.Vignon-Clementel, *Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
38. "Next Steps in Supporting Parallel Adaptive Simulations", Shephard, MS, B. FrantzDale, Jansen, KE, X. Luo, M. Nuggehally, Sahni, O, Xie, T, *Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
39. "A Framework for Performing Fluid Dynamics Simulations on Large-Scale Distributed Computers", Sahni, O, Jansen, KE, and Shephard, MS, *Proceedings of the 9th U.S. National Congress on Computational Mechanics*, San Francisco, CA, July 22-26, 2007.
40. "Turbulence in Cardiovascular Flows", Jansen, KE, Sahni, O, and Taylor, CA, *14th International Conference on Finite Elements in Flow Problems*, Santa Fe, New Mexico, March 26-28, 2007.
41. "Simulation-based Medicine: Predicting Outcomes of Cardiovascular Interventions using Computational Fluid Dynamics", Taylor, CA, Figueroa, CA, N.M. Wilson, R.L. Spilker, Kim, HJ, Vignon-Clementel, IE and Jansen, KE, *14th International Conference on Finite Elements in Flow Problems*, Santa Fe, New Mexico, March 26-28, 2007.
42. "Adaptive Flow Simulation of Turbulence in Subject Specific Abdominal Aortic Aneurysm on Massively Parallel Computers", Sahni, O, Jansen, KE, Shephard, MS, Taylor, CA, *Bulletin of the*

*American Physical Society, 60th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2007 Salt Lake City, UT.

43. "Large-scale Subject-specific Simulations of Blood Flow in Deformable Arteries using a Coupled-momentum Formulation", Figueroa, CA, Vignon-Clementel, I, Jansen, KE, Taylor, CA, *World Congress of Biomechanics*, Munich, Germany, July 29 - August 4, 2006.
44. "Outflow boundary conditions for three-dimensional simulations of non-periodic blood flow and pressure fields", Vignon, I, C.Figueroa, A. Marsden, Jansen, KE, J. Feinstein and Taylor, CA, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
45. "Inflow boundary condition using a heart model for three-dimensional simulations of blood flow", H. Kim, Vignon, I, Jansen, KE, and Taylor, CA, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
46. "An explicit C1 finite element for fluid dynamics applications", J. Evans, Jansen, KE, E. Bohr and Shephard, MS, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
47. "Adaptive anisotropic meshing of the cardiovascular system", J. Mueller, Sahni, O, Jansen, KE, Shephard, MS, and Taylor, CA, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
48. "Adaptive boundary layer meshing for viscous flow simulations", Sahni, O, Jansen, KE, Shephard, MS, M. Beall R. Nastasia and R. Sakalikar, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
49. "The coupled-momentum method for fluid-structure interactions: Verification with Womersley elastic tube theory and applications to large-scale subject specific cardiovascular models", Figueroa, C, Vignon, I, Jansen, KE and Taylor, CA, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
50. "Large eddy simulation in biomedical applications", Jansen, KE and Taylor, CA, *7th World Congress on Computational Mechanics,* 2006, Los Angeles, CA.
51. "Boundary Conditions for Three-Dimensional Finite Element Simulations of Blood Flow and Pressure in Patient Specific Abdominal Aortic Models", Vignon-Clementel, IE, A. Figueroa, Jansen, KE and Taylor, CA, II International Conference on Computational Bioengineering, H. Rodrigues Et al (Eds.) Lisbon, Portugal, Sept 2005.
52. "A Coupled-Momentum Method for Fluid-Structure Interaction: Applications to Aortic Coarctation", A. Figueroa, J.F. LaDisa, Vignon-Clementel, IE, Jansen, KE, Hughes, TJR, J.A Feinstein and Taylor, CA, II International Conference on Computational Bioengineering, H. Rodrigues Et al (Eds.) Lisbon, Portugal, Sept 2005.
53. "Simulation of Blood Flow and Vessel Deformation in Three-Dimensional, Patient-Specific Models of the Cardiovascular System using a Novel Method for Fluid-Solid Interactions", A. Figueroa, Vignon-Clementel, IE, Jansen, KE, Hughes, TJR, and Taylor, CA, III International Conference on Fluid Structure Interaction, La Coruna, Spain (2005).
54. "A Tool for the Efficient FE-simulation of Cardiovascular Flow".J. Müller, Sahni, O, X. Li, Jansen, KE, Shephard, MS, Taylor, CA, 2nd NAFEMS CFD Seminar: Simulation of Complex Flows (CFD), Niedernhausen/Wiesbaden, Germany, April 25 - 26, 2005. pp. 1-10.
55. "Influence of Different Outflow Boundary Conditions on Three-dimensional Simulations of Blood Flow and Pressure.", Vignon-Clementel, I, Figueroa, CA, Jansen, KE, Taylor, CA, *8th U.S. National Congress on Computational Mechanics*, Austin, TX, July 24-28, 2005.
56. "Simulating Blood Flow and Vessel Wall Deformation in Large Cardiovascular Models using a Coupled Momentum Formulation", Figueroa, CA, Vignon-Clementel, I, Jansen, KE, Hughes, TJR, Taylor, CA, *8th U.S. National Congress on Computational Mechanics*, Austin, TX, July 24-28, 2005.

57. "Impedance outflow boundary conditions for three-dimensional patient specific modeling of blood flow ", Vignon, I, Figueroa, CA, J. LaDisa, J.A. Feinstein, Jansen, KE, and Taylor, CA, 2005 *ASME Summer Bioengineering Conference,* Vail, Colorado.
58. "A new formulation to model blood flow and vessel motion in large, patient-specific models of the cardiovascular system", Figueroa, CA, I.E. Vignon, Jansen, KE, Hughes, TJR and C.A Taylor, 2005 *ASME Summer Bioengineering Conference,* Vail, Colorado.
59. "A variational multidomain method for solving the three-dimensional and one-dimensional equations of blood flow", Vignon, I, Figueroa, CA, J. LaDisa, J.A. Feinstein, Jansen, KE, and Taylor, CA, 2005 *SIAM Annual Meeting, New Orleans, LA*.
60. "A computationally efficient method to simulate blood flow and vessel motion in three-dimensional arterial models", Figueroa, CA, Vignon, I, Jansen, KE, and Taylor, CA, 2005 *SIAM Annual Meeting, New Orleans, LA*.
61. "Generation of Turbulent Inlet Conditions for thermal boundary layer simulation", Araya, G, E. Bohr, Jansen, KE, and Castillo, L, *Bulletin of the American Physical Society, 58th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2005 Chicago, IL.
62. "Development of new boundary conditions for flow in human airways", V.M. Marrero, Jansen, KE, *Bulletin of the American Physical Society, 58th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2005 Chicago, IL.
63. "Inflow Generation Technique for Large Eddy Simulation using Equilibrium Similarity Analysis", E. Bohr, J. Bailon-Cuba, Jansen, KE, Castillo, L, *4th AIAA Theoretical Fluid Mechanics Meeting,*Toronto, Ontario, CA, June 2005.
64. "Outflow boundary conditions for finite element modeling of blood flow in arteries", Vignon, I, Jansen, KE, and Taylor, CA, *At the 6th World Congress on Computational Mechanics,* 2004, Beijing, China.
65. "A Coupled Momentum Method to Model Blood Flow in Deformable Arteries", Figueroa, CA, Jansen, KE, Hughes, TJR, and Taylor, CA, *At the 6th World Congress on Computational Mechanics,* 2004, Beijing, China.
66. "Scaling Laws for Inflow Generation Techniques for Large Eddy Simulation of Turbulent Boundary Layers", E. Bohr, J. Bailon-Cuba, Castillo, L, Jansen, KE, *At the 57th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2004, Seattle, WA.
67. "Anisotropic Mesh Adaptivity for FE-simulation of Cardiovascular Flow", J.Mueller, Sahni, O, Jansen, KE, Shephard, MS, *At the 57th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2004, Seattle, WA.
68. "An Application of Variational Multiscale Methods Using a Hierarchical Basis to Compute Turbulent Flows", Jansen, KE, *At the Second DOE Workshop on Multiscale Mathematics*, Broomfield, Colorodo, July 2004.
69. "Local p-Refinement for Stabilized Finite Element Methods," A. Karanam and Jansen, KE, *Proceedings from 7th U.S. National Congress on Computational Mechanics*, 2003, Albuquerque, NM.
70. "LES Modeling within a Stabilized Finite Element Method," Jansen, KE and Tejada-Martinez, A, *Proceedings from 7th U.S. National Congress on Computational Mechanics*, 2003, Albuquerque, NM.
71. "A New Formulation for Modeling Blood Flow in Deformable Arteries: The Coupled Momentum Method for Fluid-Solid Interaction Problems," A. Figueroa, Jansen, KE, Hughes, TJR, and Taylor, C, *Proceedings from 7th U.S. National Congress on Computational Mechanics*, 2003, Albuquerque, NM.
72. "An Adaptive Stabilized Finite Element Analysis of Multi-phase Flows using a Level Set Approach," Jansen, KE, S. Nagrath, and Lahey Jr, RT, *Proceedings from 7th U.S. National Congress on Computational Mechanics*, 2003, Albuquerque, NM.

73. "Efficient Computational Methods for the Investigation of Vascular Disease," J. Mueller, S. Nagrath, X. Li, Jansen, KE, and Shephard, MS, *Proceedings from 7th U.S. National Congress on Computational Mechanics*, 2003, Albuquerque, NM.
74. "On the Interaction Between Dynamic Model Dissipation and Numerical Dissipation due to SUPG Stabilization," Tejada-Martinez, A and Jansen, KE, *Proceedings from 7th U.S. National Congress on Computational Mechanics*, 2003, Albuquerque, NM.
75. "Simulation of the Near-lip of a Jet", E. Bohr, M. Yaworski, and Jansen, KE, *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
76. "A dynamic Smagorinsky model with dynamic determination of the filter width ratio", A.E. Tejada-Martinez and Jansen, KE, *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
77. "Flow Simulation to enable patient specific virtual surgical planning", Jansen, KE, Taylor, CA, and J. Mueller, *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
78. "Three dimensional simulation of incompressible two-phase flows using a stabilized finite element method and level set approaches", S. Nagrath, Jansen, KE, and Lahey Jr, RT, *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
79. "An application of variational multiscale methods using a hierarchical basis to compute turbulent flows ", S.P. Simmons, A.E. Tejada-Martinez and Jansen, KE, *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
80. "The development of interfacial drag and non-drag laws for stratified wavy flow using PHASTA-2I", A. Galimov, S. Nagrath, F. Moraga, D. Drew, Lahey Jr, RT, and Jansen, KE, *Bulletin of the American Physical Society, 56th Annual Meeting of the Division of Fluid Dynamics*, Nov. 2003, Meadowlands, NJ.
81. "An evaluation of the hierarchical basis for use in variational multiscale methods for LES", Jansen, KE and A.E. Tejada-Martinez, *Proceedings from the Fifth World Congress on Computational Mechanics*, 2002, Vienna, Austria.
82. "The effect of topology and scale decomposition when using variational multiscale LES", Jansen, KE and A.E. Tejada-Martinez, *Proceedings from the U.S. National Congress on Theoretical and Applied Mechanics*, 2002, Blacksburg, VA.
83. "Finite Element Based Large-Eddy Simulation of the Near-Nozzle Region of a Compressible Round Jet," Jansen, KE, T. Maeder and R. Reba , *8th AIAA-CEAS Aeroacoustics Conference*, AIAA 2002-2538 2002, Breckenridge, CO.
84. "An unsteady incompressible flow solver for vascular flow," Jansen, KE and Taylor, CA, *6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.
85. "Simulation Based Medical Planning," Taylor, CA and Jansen, KE, *6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.
86. "Comparison of equal order and mixed order stabilized FEM formulations for incompressible flow," J. Bazilevs and Jansen, KE, *6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.
87. "Wall Modeling for Reynolds-averaged Navier-Stokes Simulations," M. Yaworski and Jansen, KE, *6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.
88. "Large Eddy Simulation and the Variational Multiscale Method," Hughes, TJR, Oberai, AA, and Jansen, KE, *6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.
89. "A comparison of the Dynamic Model and the Variational Multiscale Model for Large-Eddy Simulation", A.E Tejada-Martinez and Jansen, KE, *6th U.S. National Congress on Computational Mechanics*, 2001, Dearborn, MI.

90. "The Effect of Element Topology on Variational Multiscale Methods for LES," Jansen, KE, *American Physical Society, 53rd Annual Meeting of the Division of Fluid Dynamics*, Nov. 2000, Washington, DC.
91. "Test Filters for Dynamic Model LES on Finite Elements," A.Tejada Martinez and Jansen, KE, *American Physical Society, 53rd Annual Meeting of the Division of Fluid Dynamics*, Nov. 2000, Washington, DC.
92. "Variational Multiscale Methods for LES Using a Hierarchical Basis on Hexahedral or Tetrahedral Elements," Jansen, KE, *YES 2000: Workshop on Multiscale and Multiresolution Method*s, Oct. 2000, Yosemite, CA.
93. "Multiscale Modeling of Electrochemical Deposition and Microloading Effects," M.O. Bloomfield, Jansen, KE, and T.S. Cale, *198th Meeting of the Electrochemical Society,* October , 2000, Phoenix, AZ.
94. "Multiscale Process Modeling for Integrated Circuit Fabrication," T. S. Cale, S. Soukane, D.F. Richards, M.O. Bloomfield, and Jansen, KE, *Multiscale Materials Modeling Symposium of the International Union of Materials Research Societies 6th International Conference in Asia*, 2000, Hong Kong, China.
95. "Variational Multiscale Methods for LES using a Hierarchical Basis," Jansen, KE, C.H. Whiting and Hughes, TJR, *Finite Elements in Flow Problems*, May 2000, Austin, TX.
96. "An Examination of the Filtering Operator Used in Dynamic Model LES," A. Tejada Martinez and Jansen, KE, *Finite Elements in Flow Problems*, May 2000, Austin, TX.
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98. "Effects Of Transpiration Flow Control Of Hovering Rotor Blades," M. Dindar, Jansen, KE and A.A. Hassan, *17th Applied Aerodynamics Conference*, Norfolk VA, June 1999.
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5. "Virtual Surgical Planning" Jansen, KE, Taylor, CA, V. Favier and F. U. Danacioglu, *Multiscale Systems Engineering Research Center Planning Meeting,* 10/02, Rensselaer Polytechnic Institute, Troy, NY.
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## X. Research Interests

The motivation of my research is to provide scientists and engineers with a better predictive capability for fluid dynamics problems. I am especially interested in problems where the broad range of scales expected to be present would be impractical to completely resolve, what may be termed multiscale fluids problems. The classical example is turbulence, which provided a driver for my development of very fast, massively parallel, adaptive and highly accurate finite element methods. These methods are under continuous development and application to turbulence as well as other multiscale problems such as aerodynamic flow control, blood flow within a patient-specific diseased artery, and two-phase flows. Some detail will be given in the following sections concerning work in these areas, but before discussing applications, some discussion of the enabling research in massively parallel adaptive computational fluid dynamics will be described.

### Petascale Adaptive Computational Fluid Dynamics

To enable simulation of real world flows, my research is focused on improvements to the numerical methods used to solve the various forms of the Navier-Stokes equations. In particular, research is underway in parallel, adaptive approaches that utilize varying grid size and varying order interpolation functions to improve the approximation of the numerical method (stabilized finite element method). Further research is underway in the development of error estimators and error indicators that are necessary to drive this h-p adaptivity. This aspect of the problem is particularly difficult for unsteady flows where previously proposed error indicators may suggest adaptivity too often or too late (i.e. fine scale structures are constantly moving). We have recently developed and applied statistics-based error adaptivity that seems to hold great promise for unsteady flows. We have pioneered the development of anisotropic adaptivity that can preserve boundary layer mesh quality for viscous flows. We have demonstrated strong scalability of the flow solver up to 32k processors and are in the process of extending this to 128k processors. We are supported by the NSF (PetaApps) and the DOE (SciDAC-ITAPS, and NERI) to address the core issues required to extend these methods and the adaptivity tools that support them to petascale computers.

### Turbulence Simulation

In many flows of practical interest, turbulence plays a non-negligible role. To this end, my turbulence research, at the most applied level, seeks to develop simple models that describe the net effect or average of the turbulence upon the mean flow equations (the Reynolds-averaged Navier-Stokes (RANS) equations). These models, when combined with a fully unstructured-grid finite element method, allow engineers to model arbitrarily complex flow problems. Unfortunately, these models are not yet able to describe all turbulent flows with sufficient accuracy. Therefore, other forms of turbulence simulation are also pursued. These forms are: 1) Large-Eddy Simulation (LES) where the large scale motions of the turbulence are resolved in the computation leaving only the fine scale motions to be modeled, 2) Hybrid Models (e.g., Detached Eddy Simulations (DES)) that blend LES and RANS, and 3) Direct Numerical Simulation (DNS) where all of the turbulent motions are resolved in the computational model. These alternate forms are useful both to develop a more basic understanding of the theory of turbulence and to improve the averaged models used by engineers.

To get a sense of the scale and longevity of our large-eddy simulation effort, we may contrast the first unstructured grid study of a high lift airfoil where we solved 10 million nonlinear equations at each

time step for 150 thousand time steps (1.5 trillion nonlinear equations solved) in 1996 to our current simulations which are about 100 times larger. Some other simulations that we have performed include flow over a notch, flow within an IC engine, and more basic, well-understood flows such as decay of isotropic turbulence and channel flow. We are also undertaking a significant effort to develop new models for large eddy simulation that take advantage of the natural sum decomposition of scales afforded to finite element methods when using a hierarchical basis. We have called this new model the Variational Multiscale Model because it makes use of finite element projections rather than filters to separate the scales.

**Aerodynamic Flow Control**

The above effort in turbulence simulation has enabled a focused effort in aerodynamic flow control. The idea is to apply a relatively small flow disturbance to drive a large scale flow response. For example, synthetic jets have been shown experimentally to produce large scale flow changes (e.g., re-attachment of separated flow) from micro-scale input (e.g., a 0.1 W piezoelectric disk resonating in a cavity); a process that has yet to be explained fundamentally. Three applications of this concept are currently funded in joint, experimental-computational efforts with Michael Amitay. The first is a fundamental study of synthetic jets on wings with sweep and taper (AFOSR). The second is a detailed study of tangential blowing to reduce separation in offset engine inlet ducts (Northrup Grumman). The third is a detailed study of synthetic jets to alter the flow sufficiently to create virtual camber and thus aerodynamic control authority on commercial aircraft (Boeing support approved for Jan. 1 2009 start).

**Virtual Vascular Surgical Planning**

Turbulence is not the only mechanism that may create a broad range of scales. Another example is flow within the human cardiovascular system. Here, we are interested in studying the flow in the vicinity of a diseased arterial section. Charles Taylor at Stanford University has developed tools to rapidly extract a patient-specific solid model of the diseased arterial section from Magnetic Resonance or Computed Tomography data. Using Magnetic Resonance techniques, unsteady (pulsatile) velocity field data can be obtained to prescribe inflow boundary conditions for the simulation domain allowing it to be placed a short distance upstream of the diseased section. The downstream boundary conditions present a much greater challenge due to the unsteady nature of the flow. Charles and I (and Ph.D. students that we co-advise) are working together to develop simplified models of the downstream vascular bed to create realistic outflow boundary conditions for the computational domain. We are currently extending these techniques to include inflow conditions and elastic modeling of the artery walls which is fully coupled to the flow solver. Through this collaboration, SimVascular, was created to combine Stanford's model extraction and problem definition tools with our flow solver and adpativity in a NIH open-source repository housed in SimBios. We continue to improve these tools toward the goal of providing the real time feedback that surgical planners require to virtually test a variety of surgical options, choosing the best one in time to carry out a successful surgery.

**Two-phase flow simulation**

Richard Lahey, and I have been investigating extensions to our methods to enable two-phase flows to be efficiently simulated. We have developed Level Set methods and have applied these approaches to a variety of flows including sonoluminescense, bubbly flows, water-jet bubbled ingestion, and turbulent

annular flow. Michael Podowski and I are currently supported under a DOE NERI grant to apply these methods to nuclear reactor accident scenarios.

**Pre and post-processing**

The broad spectrum of applications listed above would not be possible without significant development of pre- and post-processing techniques. In particular, as we have moved to a hierarchical basis (where degrees of freedom are no longer limited to the nodes of a mesh but are now associated with edges, faces and regions as well) it became very important to link our pre-processing to a solid model description of the flow. This link is critical when performing adaptivity to insure that refined meshes continue to match, and therefore improve, the description of the boundary. Furthermore, by associating boundary conditions with the solid model faces, not only is the initial work of the user reduced but subsequent adaptivity will automatically inherit the appropriate boundary conditions.