

OMAR GHATTAS

John A. and Katherine G. Jackson Chair in Computational Geosciences
Director, Center for Computational Geosciences
Institute for Computational Engineering and Sciences
Professor of Geological Sciences, Jackson School of Geosciences
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1 Biographical data

A. Education:

- B.S.E., Department of Civil Engineering, Duke University, Durham, North Carolina, 1984
- M.S. Computational Mechanics, Department of Civil and Environmental Engineering, Duke University, Durham, North Carolina, 1986
- Ph.D. Computational Mechanics, Department of Civil and Environmental Engineering, Duke University, Durham, North Carolina, 1988

B. Former and Current Positions and Appointments:

- John A. and Katherine G. Jackson Chair in Computational Geosciences and Director of the Center for Computational Geosciences, Institute for Computational Engineering and Sciences (ICES), University of Texas at Austin, 9/05–
- Professor of Geological Sciences, Jackson School of Geosciences, University of Texas at Austin, 9/05–
- Professor of Mechanical Engineering, College of Engineering, University of Texas at Austin, 9/05–
- Professor (by courtesy), Departments of Biomedical Engineering and Computer Sciences, University of Texas at Austin, 9/05–
- Research Professor, Institute for Geophysics, University of Texas at Austin, 9/05–
- Adjunct Professor, Department of Civil and Environmental Engineering, Carnegie Mellon University, 9/05–
- Professor, Department of Biomedical Engineering, Carnegie Mellon University, 7/02–8/05
- Professor, Department of Civil and Environmental Engineering and Biomedical Engineering program, Carnegie Mellon University, 7/01–8/05
- Visiting Professor, Institute for Scientific Computing Research, Lawrence Livermore National Laboratory, Livermore, CA, multiple visits, 3/01–10/03
- Visiting Professor, Computer Science Research Institute, Sandia National Laboratories, Albuquerque, NM, multiple visits, 08/99–present
- Associate Professor, Biomedical and Health Engineering, Carnegie Mellon University, Pittsburgh, PA, 12/99–6/01
- Associate Professor with Tenure, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA, 7/98–6/01
- Visiting Scientist, Institute for Computer Applications in Science and Engineering, NASA Langley Research Center, Hampton, VA, 7/97–8/97
- Associate Professor, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA, 7/94–6/98

- Affiliated faculty, Robotics Institute, School of Computer Science, Carnegie Mellon University, Pittsburgh, PA, 5/93–8/05
- Affiliated faculty, Biomedical Engineering Program, Carnegie Mellon University, Pittsburgh, PA, 9/92–12/99
- Affiliated faculty, Engineering Design Research Center/Institute for Complex Engineered Systems, Carnegie Mellon University, Pittsburgh, PA, 5/90–8/05
- Assistant Professor, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA, 8/89–6/94
- Post-Doctoral Research Associate, Department of Civil and Environmental Engineering, Duke University, Durham, NC, 1/89–7/89

C. Consulting Assignments:

- Member of the Technical Advisory Board and consultant to the development group, Algor, Inc., 150 Beta Drive, Pittsburgh, PA 15238, 5/93–5/98.

2 Teaching and Education

A. Courses Taught at UT-Austin:

Number	Title	Units	Class	Size	Offered	Course	Instructor
ME-397/CAM-397	Optimization of PDEs	3	Gr	12	S06	4.20	4.50
GEO-391	Comp Methods in Geophysics	3	Gr	6	F06	5.0	5.0

B. Courses Taught at CMU:

(4.39 lifetime instructor average)

Number	Title	Units	Class	Size	Offered	FCE–Course	FCE–Instr.
12-701	Opt & Mod CivE Syst	9	Gr	12	F89	4.58	4.42
12-621	Structural Mech II ^b	9	Jr,Sr	7	S90	4.00	4.17
12-759	Adv Tpc Design Opt ^a	9	Gr	4	S90	4.50	4.50
12-755	Finite Elem Mech I	9	Gr	10	F90	4.40	4.50
12-621	Structural Mech II	9	Jr,Sr	21	S91	4.00	3.76
12-756	Finite Elem Mech II ^{a,b}	9	Gr	12	S91	4.75	4.63
12-755	Finite Elem Mech I	9	Gr	15	F91	4.43	4.50
12-212	Solid Mechanics	12	Soph	43	S92	3.45	3.13
12-759	Optimization in Mech ^a	9	Gr	7	S92	4.75	4.75
12-755	Finite Elem Mech I	9	Gr	11	F92	4.62	4.50
12-325	Soil Mechanics ^b	12	Jr	33	S93	3.48	3.57
12-212	Solid Mechanics	12	Soph	40	S93	4.30	4.23
12-755	Finite Elem Mech I	12	Gr	13	F93	4.31	4.38
12-756	Finite Elem Mech II	9	Gr	8	S94	4.50	4.63
12-647	Jr. Project Seminar	3	Jr	29	S94	—	—
12-755	Finite Elem Mech I	9	Gr	17	F94	4.87	4.73
12-759	Optimization in Mech	9	Gr	9	S95	4.56	4.78
12-755	Finite Elem Mech I	9	Gr	17	F95	4.88	4.81
12-235	Statics	9	Soph	37	S96	4.47	4.41
12-755	Finite Elem Mech I	12	Gr	16	F96	4.25	4.38
12-759	Optimization in Mech	12	Gr	8	S97	4.75	4.88
12-755	Finite Elem Mech I	12	Gr	27	F97	4.64	4.60
12-756	Finite Elem Mech II ^a	12	Gr	14	S98	4.33	4.50
12-755	Finite Elem Mech I	12	Gr	5	F98	5.00	5.00
12-355	Fluid Mechanics	9	Jr	34	S99	2.67	3.08
12-755	Finite Elem Mech I	12	Gr	19	F99	4.74	4.79
12-355	Fluid Mechanics	9	Jr	19	S00	4.33	4.50
12-755	Finite Elem Mech I	12	Gr	9	F01	4.97	4.98
12-271	Comp Appl in CEE ^b	9	Soph	26	F01	4.19	4.00
12-704	Prob & Estim Methods	12	Gr	21	F02	4.28	4.33
12-768	Comp Biofluid Dynam ^a	12	Gr	10	S03	4.72	4.72
12-759	Optimization of PDEs ^a	12	Gr	16	F03	4.00	4.00
42-705	Var Image Processing ^a	12	Gr	5	F04	4.50	5.00
12-355	Fluid Mechanics	9	Jr	22	S05	4.12	4.62

a. new course

b. team taught

C. Student Projects

a. Undergraduate Projects

1. Ralph Croushore, Simulation and animation of membrane vibration with *Mathematica*, Fall 1989.
2. Chris Visnic, Conjugate gradient methods for structural analysis, Fall 1991.
3. Scott Luckenbaugh, A graphical user interface for structural analysis, Fall 1991.
4. Eric Groppe, A *Mathematica*-based mesh generator for arbitrary plane domains, Fall 1991.
5. William Barry, Conjugate gradients for a problem in nonlinear elasticity, Fall/Spring 1992.
6. Nausheen Ahmad (Electrical and Computer Engineering), Mapping irregular finite element meshes on massively-parallel multiprocessors, Spring 1992.
7. Matt Bednar, Computer simulation of granular systems, Fall 1992.
8. Young Cho, Experimental characterization of stress distribution within the femur, Spring 1993 (jointly advised with L. Cartwright and B. Jaramaz).

9. Chris Papadopolous, Optimal design of composites, Fall/Spring 1993.
10. Alim Ray (Chemical Engineering), Some heuristics for partitioning unstructured meshes, Summer 1993.
11. Eric Robl, Finite element modeling of art objects, Fall 1993.
12. Amy Wright, Finite element modeling of hip implantation, Fall/Spring 1994 (jointly advised with B. Jaramaz).
13. Lori Gregor (Mechanical Engineering), Robot- and computer-assisted surgery, Summer 1994 (jointly advised with R. O'Toole).
14. Pun Panthaworn, Analysis of frame structures with FeLT, Fall 1994.
15. Gordon Cheng (Computer Science), Mesh generation for large sedimentary basins, Summer 1995.
16. Stephanie Kladakis (Biomedical Engineering, Harvard), A range-of-motion simulator for total hip replacement surgery, Summer 1995 (jointly advised with B. Jaramaz).
17. Miroslav Trubelja, Finite element analysis of a Robert Maillart bridge, Fall 1995.
18. Tushith Islam, Solid modeling and mesh generation of red blood cells, Summer 2002.

b. Master's Students

1. Tadaji Wakabayashi, Computational efficiency and storage requirements for the hierarchical and simultaneous methods in structural optimization, June 1990.
2. Shyan-Ching Jang, Computational strategies for large-scale structural inverse problems, September 1990.
3. Pei-Chi Huang, Range and null space finite element methods for viscous incompressible flow, August 1991.
4. Susan Schrader, Topological and discrete-sizing optimal design of trusses, August 1991.
5. Jai-Hyeong Bark, Topological optimization of continua, December 1992.
6. Weiyue Lee, Truncated-Newton methods for shape optimization of solids, December 1992 (M.S. project).
7. Christopher Visnic, Mechanical consequences of press fitting an uncemented acetabular implant, May 1994 (co-advised with B. Jaramaz).
8. Madhavi Vuppalapati, A Poisson element in FeLT, September 1994 (M.S. project).
9. Sameer Shah, Fictitious domain methods for elasticity problems and applications to problems in biomechanics, May 1996.
10. George Biros, 2D contour smoothing and surface reconstruction of tubular CT-scanned anatomical structures, December 1996 (co-advised with B. Jaramaz).
11. Larisa Goldmints, Biomechanics of press-fit acetabular component in total hip replacement: Idealized 3-D model, May 1997, (co-advised with B. Jaramaz).
12. Ivan Malcevic, Parallel shape optimization for large-scale problems, May 1997.
13. Volkan Akcelik, Orthogonal grid generation for anatomic structures, May 1998 (co-advised with B. Jaramaz).
14. Jianlin Wang, Octree-based finite element method for elastic wave propagation with application to earthquake ground motion, May 1999 (co-advised with J. Bielak).
15. Ioannis Epanomeritakis, A study of the seismic inverse problem for a layer on a halfspace, May 1999 (co-advised with J. Bielak).
16. Anurag Gupta, The Green-Galerkin Method: A New Meshfree Approach to Boundary Value Problems, May 1999 (co-advised with J. Bielak).
17. Eiris Boerner, A Finite Element Method for Incompressible Finite Elasticity, with Application to Red Blood Cell Deformation, April 2002 (M.S. awarded by Chalmers University, research conducted at CMU).

18. Jenny Berschling, Parameter identification for variably saturated flow through heterogeneous porous media, May 2003 (co-advised with V. Akçelik).

c. Ph.D. Students

BME = Biomedical Engineering degree

CM = Computational Mechanics degree

CS&E = Computational Science and Engineering degree

1. Carlos Orozco (CM), Large-scale shape optimization: Numerical methods, parallel algorithms, and applications to aerodynamic design, May 1993. Currently Associate Professor, Department of Engineering Technology, University of North Carolina-Charlotte.
2. Xiaogang Li (CM), A variational finite element method for fully-coupled nonlinear fluid-solid interaction, December 1995. Currently software development engineer, Algor, Inc., Pittsburgh, PA.
3. Jai-Hyeong (Jay) Bark (CM), Optimal velocity control of Navier-Stokes flows, with applications to viscous drag reduction, December 1995. Currently Senior Lecturer, Department of Architectural Engineering, Mokwon University, Taejeon, Korea.
4. Beichang (Bert) He (CM), Shape optimization of Navier-Stokes flows, with application to design of artificial heart devices, May 1996. Currently member of the technical staff, Engineering Mechanics Laboratory, GE Global Research, Niskayuna, NY.
5. Jifeng Xu (CM), Three-dimensional simulations of wave propagation in inelastic media on parallel computers with application to seismic response, January 1998. Currently Mathematics and Computing Specialist, Mathematics & Engineering Analysis, Boeing, Bellevue, WA (co-advised with J. Bielak).
6. Hesheng Bao (CM), Finite element simulation of earthquake ground motion in realistic basins, February 1998. Currently Software Design Engineer, Eaton Corporation, Pittsburgh, PA (co-advised with J. Bielak).
7. George Biros (CS&E), Parallel Lagrange-Newton-Krylov-Schur methods for PDE-constrained optimization, with application to optimal control of viscous flows, September 2000. Currently Assistant Professor, Dept. of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, PA
8. Ivan Malcevic (CS&E), A parallel dynamic mesh Lagrangian method for Navier Stokes flows with deformable boundaries, May 2001. Currently member of the technical staff, Engineering Mechanics Laboratory, GE Global Research, Niskayuna, NY.
9. Volkan Akçelik (CS&E), Multiscale Newton-Krylov methods for inverse acoustic wave propagation, (co-advised with B. Jaramaz), February 2002. Currently research scientist, Stanford Linear Accelerator Center.
10. Eui-Joong Kim (CS&E), Parallel octree-based multiresolution mesh method for large-scale earthquake ground motion simulation, (co-advised with J. Bielak), January 2003. Currently research associate, Duke University.
11. Larisa Goldmints (CS&E), Fast automated image-based patient-specific biomechanical modeling (co-advised with B. Jaramaz), May 2003. Currently postdoctoral associate, Rennsaelear Polytechnic Institute.
12. Clemens Kadow (CS&E), Parallel Delaunay refinement mesh generation, (co-advised with G. Blelloch, G. Miller, and N. Walkington), May 2004. Currently with McKinsey & Company.
13. Judith Hill (CS&E), Phase field methods for flows with elastic membranes, (co-advised with N. Walkington), May 2004. Currently at Sandia National Laboratories.
14. Ioannis Epanomeritakis (CS&E), Elastic inversion for earthquake ground motion modeling, (co-advised with J. Bielak), September 2004. Currently consultant.

15. Alexandre Cunha (CS&E), A fully Eulerian method for shape optimization with application to Navier-Stokes flows, September 2004. Currently postdoctoral associate, UCLA.
16. Ioanna Pagani (BME), Mechanics of erythrocyte cytoskeletons (co-advised with P. LeDuc), January 2006. Currently postdoctoral associate, UC Berkeley.
17. Aysegul Askan (CS&E), Inverse viscoelastic wave propagation, (co-advised with J. Bielak), September 2006. Currently postdoctoral associate, CMU.
18. Pearl Flath (CAM), expected 2010.
19. Jennifer Dieringer (CAM), expected 2010.
20. Shan Yang (CAM), expected 2010. (co-advised with R. Moser)
21. James Martin (CAM), expected 2011. (co-advised with T. Hughes)
22. Scott Lipton (CAM), expected 2011. (co-advised with T. Hughes)

D. Postdoctoral Fellows

1. Loukas Kallivokas, Large-scale earthquake modeling and orthopaedics biomechanics modeling, 5/95–8/97. Currently Associate Professor, Department of Civil & Environmental Engineering, University of Texas, Austin.
2. Volkan Akçelik, Algorithms for large-scale inversion, optimal control, and optimal design, and applications to seismic inversion, source localization for contaminant transport, groundwater remediation, and shape optimization of electromagnetic systems, 4/02–7/04.
3. Eui Joong Kim, Large-scale earthquake modeling, 1/03–12/03.
4. Judith Hill, Microstructural blood flow modeling; source localization for contaminant transport; 5/04–8/05.
5. Clemens Kadow, Parallel Delaunay refinement mesh generation, 5/04–8/04.
6. Alexandre Cunha, shape optimization, image processing, 9/04–8/05.
7. Carsten Burstedde, earthquake inversion, optimal control and inverse problems, 5/06–
8. Seong-Won Na, seismic inversion, 6/06–
9. Lucas Wilcox, uncertainty estimation and propagation, 8/06–
10. Georg Stadler, dynamic earthquake rupture models, inverse problems, image processing, 9/06–

E. Educational Contributions

- Introduced new courses at CMU in:
 - Optimization in mechanics
 - Numerical algorithms in computational science & engineering
 - Advanced finite elements
 - Computational biofluid dynamics
 - Optimal control and inverse problems for PDEs
 - Variational image processing
- Taught short and long courses in PDE-based optimization at:
 - Sandia National Laboratories, November 2000 – February 2001
 - Lawrence Livermore National Laboratory, March 2001 – May 2001
 - *Workshop on Optimization in Simulation-Based Models*, Institute for Mathematics and Its Applications, University of Minnesota, Minneapolis, MN, January 7, 2003.
 - *SIAM Conference on Computational Science and Engineering*, Orlando, FL, February 11, 2005.

3 Publications

A. Books

1. L. Biegler, O. Ghattas, M. Heinkenschloss, and B. van Bloemen Waanders, eds., *Large-Scale PDE-Constrained Optimization*, Lecture Notes in Computational Science and Engineering, Springer-Verlag, 2003.
2. L. Biegler, O. Ghattas, M. Heinkenschloss, D. Keyes, and B. van Bloemen Waanders, eds., *Real-time PDE-Constrained Optimization*, SIAM series on Computational Science and Engineering, SIAM, 2007.

B. Manuscripts

1. V. Akcelik, G. Biros, A. Drăgănescu, J. Hill, O. Ghattas, and B. van Bloemen Waanders, A multigrid method for inverse transport problems, manuscript.
2. J. Hill, N. Walkington, and O. Ghattas, Eulerian Methods for Flows with Elastic Membranes, manuscript.
3. V. Akcelik, J. Bielak, I. Epanomeritakis, and O. Ghattas, Multiscale TV-regularized Newton-Krylov optimization for seismic inversion of elastic moduli in three-dimensional heterogeneous basins, manuscript.

C. Refereed Papers

1. O. Bashir, O. Ghattas, J. Hill, B. van Bloemen Waanders, and K. Willcox, Hessian-based model reduction for large-scale data assimilation problems, *2007 International Conference on Computational Science*, Beijing, China, accepted.
2. O. Bashir, K. Willcox, O. Ghattas, B. van Bloemen Waanders, and J. Hill, Hessian-based model reduction for large-scale systems with initial condition inputs, *International Journal for Numerical Methods in Engineering*, 2007, accepted.
3. I. Pagani, A. Quist, O. Ghattas, R. Lal, P.R. LeDuc, Understanding subcellular structural domains in red blood cells through atomic force microscopy and confocal microscopy, *Blood*, submitted.
4. I. Pagani, H. Simon, O. Ghattas, P. LeDuc, Probing actin distribution in red blood cells using microfluidics, *Biotechnology and Bioengineering*, accepted, 2006.
5. L.F. Kallivokas, S.-W. Na, O. Ghattas, B. Jaramaz, Assessment of a fictitious domain method for patient-specific biomechanical simulation of press-fit orthopedic implantation, *International Journal on Numerical Methods in Engineering*, accepted pending revision.
6. T. Bui-Thanh, K. Willcox, O. Ghattas, B. van Bloemen Waanders, Goal-oriented, model-constrained optimization for reduction of large-scale systems, *Journal of Computational Physics*, to appear.
7. V. Akcelik, G. Biros, O. Ghattas, J. Hill, D. Keyes, and B. van Bloemen Waanders, Parallel PDE constrained optimization, in *Frontiers of Parallel Computing*, M. Heroux, P. Raghaven, and H. Simon, eds, SIAM, 2006.
8. T. Tu, H. Yu, L. Ramirez-Guzman, J. Bielak, O. Ghattas, K.-L. Ma, D.R. O'Hallaron, From mesh generation to scientific visualization: An end-to-end approach to parallel supercomputing, *Proceedings of SC06*, Tampa Florida, Nov. 2006.
9. V. Akcelik, G. Biros, A. Drăgănescu, O. Ghattas, J. Hill, and B. van Bloemen Waanders, Inversion of Airborne Contaminants in a Regional Model, *Proceedings of 6th International Conference on Computational Science (ICCS 2006)*, Lecture Notes in Computer Science, Vol. 3991, Springer, Reading, UK, May 2006.
10. B. Bader, O. Ghattas, B. van Bloemen Waanders, and K. Willcox, An optimization framework for goal-oriented model-based reduction of large-scale systems, *44th IEEE Conference on Decision and Control*, Seville, Spain, December 2005.

11. J. Bielak, O. Ghattas, and E.J. Kim, Parallel octree-based finite element method for large-scale earthquake ground motion simulation, *Computer Modeling in Engineering and Sciences*, 10(2):99–112, 2005.
12. V. Akcelik, O. Ghattas, D. Keyes, K. Ko, L.-Q. Lee, and E. Ng, Adjoint methods for electromagnetic shape optimization of the low-loss cavity for the International Linear Collider, *Journal of Physics: Conference Series*, 16:435–445, 2005.
13. L.-Q. Lee, L. Ge, Z. Li, C. Ng, G. Schussman, K. Ko, E. Ng, W. Gao, P. Husbands, X. Li, C. Yang, V. Akcelik, O. Ghattas, D. Keyes, T. Tautges, H. Kim, J. Craftcheck, P. Knupp, L. Freitag Diachin, K.-L. Ma, Z. Bai, and G. Golub, Achievements in ISICs/SAPP collaborations for electromagnetic modeling of accelerators, *Journal of Physics: Conference Series*, 16:205–209, 2005.
14. K Ko, N Folwell, L Ge, A Guetz, V Ivanov, A Kabel, M Kowalski, L Lee, Z Li, C Ng, E Prudencio, G Schussman, R Uplenchwar, L Xiao, E Ng, W Gao, X Li, C Yang, P Husbands, A Pinar, D Bailey, D Gunter, L Diachin, D Brown, D Quinlan, R Vuduc, P Knupp, K Devine, J Kraftcheck, O Ghattas, V Akcelik, D Keyes, M Shephard, E Seol, A Brewer, G Golub, K Ma, H Yu, Z Bai, B Liao, T Tautges and H Kim, Impact of SciDAC on accelerator projects across the Office of Science through electromagnetic modeling, *Journal of Physics: Conference Series*, 16:195–204, 2005.
15. V. Akcelik, G. Biros, A. Dragenescu, J. Hill, O. Ghattas, and B. van Bloemen Waanders, Dynamic data-driven inversion for terascale simulations: Real-time identification of airborne contaminants, *Proceedings of SC05*, IEEE/ACM, Seattle, WA, November 2005.
16. T. Tu, D. O’Hallaron, and O. Ghattas, Scalable parallel octree meshing for terascale applications, *Proceedings of SC05*, IEEE/ACM, Seattle, WA, November 2005.
17. G. Biros and O. Ghattas, Parallel Lagrange-Newton-Krylov-Schur Methods for PDE-Constrained Optimization. Part I: The Krylov-Schur Solver, *SIAM Journal on Scientific Computing*, 27(2):687–713, 2005.
18. G. Biros and O. Ghattas, Parallel Lagrange-Newton-Krylov-Schur Methods for PDE-Constrained Optimization. Part II: The Lagrange-Newton Solver, and its Application to Optimal Control of Steady Viscous Flows, *SIAM Journal on Scientific Computing*, 27(2):714–739, 2005.
19. V. Akcelik, J. Bielak, G. Biros, I. Epanomeritakis, O. Ghattas, L. Kallivokas, and E. Kim, “An Online Framework for Inversion-Based 3D Site Characterization,” *Lecture Notes in Computer Science*, vol. 3038, p. 717–724, Springer, 2004.
20. V. Akcelik, J. Bielak, G. Biros, I. Epanomeritakis, A. Fernandez, O. Ghattas, E. Kim, J. Lopez, D. O’Hallaron, and T. Tu, and J. Urbanic, High-resolution forward and inverse earthquake modeling on terascale computers, *Proceedings of SC2003*, Phoenix, AZ, November 2003.
21. K.-L. Ma, A. Stompel, J. Bielak, O. Ghattas, and E. Kim, Visualizing very large-scale earthquake simulations, *Proceedings of SC2003*, Phoenix, AZ, November 2003.
22. J. Xu, J. Bielak, O. Ghattas, and J. Wang, Three-dimensional nonlinear seismic ground motion modeling in basins, *Physics of the Earth and Planetary Interiors*, 137(1–4):81–95, 2003.
23. G. Biros and O. Ghattas, Inexactness Issues in the Lagrange-Newton-Krylov-Schur method, in *Large-Scale PDE-Constrained Optimization*, L. Biegler, O. Ghattas, M. Heinkenschloss, and B. van Bloemen Waanders, eds., Springer-Verlag, Lecture Notes in Computational Science and Engineering series, Heidelberg, 2003.
24. V. Akcelik, G. Biros, O. Ghattas, K.R. Long, and B. van Bloemen Waanders, A Variational Finite Element Method for Source Inversion for Convective-Diffusive Transport, *Finite Elements in Analysis and Design*, 39:683–705, 2003.
25. I. Malcevic and O. Ghattas, Dynamic Mesh Finite Element Method for Lagrangian Computational Fluid Dynamics, *Finite Elements in Analysis and Design*, 38(10):965–982, 2002.
26. V. Akcelik, G. Biros, and O. Ghattas, Parallel Multiscale Gauss-Newton-Krylov Methods for Inverse Wave Propagation, *Proceedings of SC2002*, Baltimore, MD, Nov. 2002. (Received Best Technical Paper Award).

27. V. Akcelik, B. Jaramaz, and O. Ghattas, Nearly Orthogonal Two-Dimensional Grid Generation with Aspect Ratio Control, *Journal of Computational Physics*, 171(2):805–821, 2001.
28. S. Bollapragada, O. Ghattas, and J.N. Hooker, Optimal Design of Truss Structures by Logic-Based Branch and Cut, *Operations Research*, 41(1):42-51, Jan–Feb 2001.
29. J. Antaki, G. Blelloch, O. Ghattas, I. Malcevic, G. Miller, N. Walkington, A Parallel Dynamic-Mesh Lagrangian Method for Simulation of Flows with Dynamic Interfaces, *Proceedings of SC2000*, Dallas, Texas, Nov. 2000.
30. G. Biros and O. Ghattas, Parallel Newton-Krylov Methods for PDE-Constrained Optimization, *Proceedings of Supercomputing '99*, Portland, OR, November 1999.
31. G. Biros and O. Ghattas, Parallel Domain Decomposition Methods for Optimal Control of Viscous Incompressible Flows, *Proceedings of Parallel CFD '99*, Williamsburg, Virginia, USA, May 23-26, 1999.
32. J. Bielak, J. Xu, and O. Ghattas, Earthquake Ground Motion and Structural Response in Alluvial Valleys, *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 125, No. 5, pp. 404-412, May 1999.
33. Y. Hisada, H. Bao, J. Bielak, O. Ghattas, D. O'Hallaron, Simulations of Long-Period Ground Motions during the 1995 Hyogoken-Nanbu (Kobe) Earthquake using 3D Finite Element Method, *Proceedings of the 2nd International Symposium on Effect of Surface Geology on Seismic Motion*, Yokohama, Japan, December 1998.
34. O. Ghattas and X. Li, Domain Decomposition Methods for Sensitivity Analysis of A Nonlinear Aeroelasticity Problem, *International Journal of Computational Fluid Dynamics*, Vol. 11, pp. 113–130, 1998.
35. H. Bao, J. Bielak, O. Ghattas, L.F. Kallivokas, D.R. O'Hallaron, J.R. Shewchuk, and J. Xu, Large-Scale Simulation of Elastic Wave Propagation in Heterogeneous Media on Parallel Computers, *Computer Methods in Applied Mechanics and Engineering*, Vol.152, No.1–2, P.85–102, 1998.
36. O. Ghattas and J. Bark, Optimal Control of Two- and Three-Dimensional Incompressible Navier Stokes Flows, *Journal of Computational Physics*, Vol.136, P.231–244, 1997.
37. C.E. Orozco and O. Ghattas, A Reduced Sand Method for Optimal Design of Nonlinear Structures, *International Journal for Numerical Methods in Engineering*, Vol.40, No.2, pp. 2759–2774, 1997.
38. O. Ghattas and J. Bark, Large-scale SQP methods for optimization of Navier-Stokes flows, *Large-Scale Optimization with Applications; Part II: Optimal Design and Control*, Vol. 93, pp. 247–270, IMA Volumes in Mathematics and its Applications, L.T. Biegler, T.F. Coleman, A.R. Conn, and F.N. Santosa, eds., Springer-Verlag, 1997.
39. O. Ghattas and C.E. Orozco, A parallel reduced Hessian SQP method for shape optimization, *Multidisciplinary Design Optimization: State-of-the-Art*, N.M. Alexandrov and M.Y. Hussaini, eds., SIAM, 1997, pp. 133-152.
40. H. Bao, J. Bielak, O. Ghattas, L. Kallivokas, D. O'Hallaron, J. Shewchuk, and J. Xu, Earthquake Ground Motion Modeling on Parallel Computers, in *Proceedings of Supercomputing '96*, Pittsburgh, November 1996.
41. C.E. Orozco and O. Ghattas, Infeasible Path Optimal Design Methods, with Application to Aerodynamic Shape Optimization, *AIAA Journal*. Vol.34, No.2, pp. 217–224, 1996.
42. J.F. Antaki, O. Ghattas, G.W. Burgreen, B. He, Computational Flow Optimization of Rotary Blood Pump Components, *Artificial Organs*, Vol.19, No.7, pp. 608–615, 1995.
43. O. Ghattas and X. Li, A Variational Finite Element Method for Stationary Nonlinear Fluid-Solid Interaction, *Journal of Computational Physics*, Vol. 121, pp. 347–356, 1995.
44. S. Shah, L. Kallivokas, B. Jaramaz, O. Ghattas, and A.M. Digioia, The Fictitious Domain Method for Patient-Specific Biomechanical Modeling: Promise and Prospects, *Proceedings of The Second International Symposium on Medical Robotics and Computer-Assisted Surgery (MRCAS95)*, pp. 329–333, Baltimore, MD, November 1995.

45. R.V. O'Toole, D.A. Simon, B. Jaramaz, O. Ghattas, M.K. Blackwell, L. Kallivokas, F. Morgan, C. Visnic, A.M. Digioia, and T. Kanade, Towards More Capable and Less Invasive Robotic Surgery in Orthopaedics, *Proceedings of The First International Conference on Computer Vision, Virtual Reality, and Robotics in Medicine (CVRMed95)*, pp. 123–130, Nice, France, April 1995.
46. J.R. Shewchuk and O. Ghattas, A Compiler for Parallel Finite Element Methods with Domain-Decomposed Unstructured Meshes, *Contemporary Mathematics*, Vol. 180, pp. 445–450, 1994.
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48. E. Schwabe, G. Blelloch, A. Feldmann, O. Ghattas, J. Gilbert, G. Miller, D. O'Hallaron, J. Shewchuk, and S. Teng, A Separator-Based Framework for Automated Partitioning and Mapping of Parallel Algorithms for Numerical Solution of PDEs, in *Issues and Obstacles in The Practical Implementation of Parallel Algorithms and The Use of Parallel Machines*, pp. 48–62, Dartmouth, June, 1992.
49. C.E. Orozco and O. Ghattas, Massively Parallel Aerodynamic Shape Optimization, *Computing Systems in Engineering*, Vol. 3, No. 1, pp. 311–320, 1992.
50. C.E. Orozco and O. Ghattas, A Sparse Approach to Simultaneous Analysis and Design of Geometrically-Nonlinear Structures, *AIAA Journal*, Vol.30, No.3, pp. 1877–1885, 1992.
51. I.E. Grossmann, V.T. Voudouris, and O. Ghattas, Mixed-integer linear programming formulations of some nonlinear discrete design optimization problems, *Recent Advances in Global Optimization*, pp. 478–512, C.A. Floudas and P.M. Pardalos, eds., Princeton University Press, 1992.
52. G.M. Turkiyyah and O. Ghattas, Geometric Reasoning for Shape Design, *Proceedings of The Ninth National Conference on Artificial Intelligence (AAAI-91)*, pp. 874–879, Irvine, CA, July 1991.
53. O. Ghattas, The Minimum Bandwidth Problem As An Assignment Problem with Side Constraints, *Engineering Optimization*, Vol. 15, No. 3, pp. 163–169, 1990.
54. R.J. Melosh, H.A. Smith, and O. Ghattas, A technology in transition: finite element analysis, *Developments in Theoretical and Applied Mechanics*, Vol. 14, pp. 1–16, S.Y. Wang, R.M. Hackett, S.L. Deleuw, and A.M. Smith, eds., University of Mississippi, 1988.
55. M. Biswas, O. Ghattas, and H. Vladimirov, Fatigue and Freeze-Thaw Resistance of Epoxy Mortar, *Transportation Research Record*, 1041, 1985.

D. Other Papers

1. V. Akcelik, J. Bielak, I. Epanomeritakis, O. Ghattas, and E. Kim, “High fidelity forward and inverse earthquake modeling in large basins,” *Proceedings of the Sixth European Conference on Structural Dynamics EUROdyn05*, Paris, France, September 2005.
2. E. Kim, J. Bielak, and O. Ghattas, “Large-scale Northridge Earthquake simulation using octree-based multiresolution mesh method,” *Proceedings of 16th ASCE Engineering Mechanics Conference*, Seattle, Washington, July 2003.
3. L. Biegler, O. Ghattas, M. Heinkenschloss, and B. van Bloemen Waanders, Large-scale PDE-constrained optimization: An introduction, in *Large-Scale PDE-Constrained Optimization*, L. Biegler, O. Ghattas, M. Heinkenschloss, and B. van Bloemen Waanders, eds., Springer-Verlag, Lecture Notes in Computational Science and Engineering series, Heidelberg, 2003.
4. O. Ghattas and I. Malcevic, Parallel dynamic unstructured mesh methods with application to Lagrangian simulation of flows with deformable boundaries, *Proceedings of the 7th International Conference on Numerical Grid Generation in Computational Field Simulations*, Whistler, BC, September 25–28, 2000.
5. V. Akcelik, B. Jaramaz, and O. Ghattas, Automated CT-based generation of three-dimensional anatomic meshes, *Proceedings of ICMMB-11: International Conference on Mechanics in Medicine and Biology*, Maui, Hawaii, April 2000.

6. J. Bielak, Y. Hisada, H. Bao, J. Xu, and O. Ghattas, One- Vs Two- Or Three- Dimensional Effects in Sedimentary Valleys, *Proceedings of The 12th World Conference on Earthquake Engineering*, New Zealand, February 2000.
7. J. Bielak, H. Bao, and O. Ghattas, Ground motion modeling using 3D finite element methods, *Proceedings of the 2nd International Symposium on Effect of Surface Geology on Seismic Motion*, Yokohama, Japan, December 1998.
8. B. He, O. Ghattas, and J.F. Antaki, Continuous shape sensitivity of incompressible Navier-Stokes flows, *Proceedings of the Seventh AIAA/USAF/NASA/ISSMO Symposium on Multidisciplinary Analysis and Optimization*, St. Louis, Missouri, September 1998.
9. L.F. Kallivokas, B. Jaramaz, O. Ghattas, S.V. Shah, A.M. DiGioia III, Biomechanics-based pre-operative planning in THR –Application of fictitious domain method, in *Advances in Bioengineering*, BED-Vol. 33, 389–390, Winter Annual Meeting, ASME, Atlanta, Georgia, November 1996.
10. J. Bielak, O. Ghattas, T.R. Gross, and D.R. O’Hallaron, Strategic research directions in earthquake ground motion modeling on parallel computers, *ACM Workshop on Strategic Directions in Computing Research*, Cambridge, MA, June, 1996.
11. C.E. Orozco and O. Ghattas, A reduced SAND method for nonlinear design problems in mechanics, *Proceedings of the 37th Structures, Structural Dynamics, and Materials Conference*, pp. 996–1004, Salt Lake City, UT, April 1996.
12. J. Bielak, K. Aki, O. Ghattas, T. Gross, D.R. O’Hallaron, F. Sanchez-Sesma, H. Bao, Y. Hisada, L.F. Kallivokas, J.R. Shewchuk, J.M. Stichnoth, and J. Xu, Earthquake ground motion modeling in large basins, *Proceedings of the NSF Grand Challenges Workshop*, Washington, D.C., March 1996.
13. T. Kanade, A.M. DiGioia, O. Ghattas, B. Jaramaz, M. Blackwell, L.F. Kallivokas, F. Morgan, S. Shah, and D.A. Simon, Simulation, planning, and execution of computer-assisted surgery, *Proceedings of the NSF Grand Challenges Workshop*, Washington, D.C., March, 1996.
14. R.H. Reid, A.M. DiGioia, B. Jaramaz, and O. Ghattas, Press-fit femoral implants yield high assembly strains in cortical bone, in *Proceedings of the 1995 Bioengineering Conference*, ASME-Bioengineering Division, vol. 29, pp. 561-562, 1995.
15. B. He, O. Ghattas, J. Antaki, and T. Dennis, Shape optimization of Navier Stokes flows, with application to optimal design of artificial heart components, *Proceedings of the Fifth AIAA/NASA/USAF/ISSMO Symposium on Multidisciplinary Analysis and Optimization*, pp. 1202–1212, Panama City, FL, September 1994.
16. O. Ghattas and X. Li, A variational finite element method for nonlinear fluid-solid interaction and its sensitivity analysis, *Proceedings of the Fifth AIAA/NASA/USAF/ISSMO Symposium on Multidisciplinary Analysis and Optimization*, Panama City, FL, September 1994.
17. C. Visnic, A.M. DiGioia, B. Jaramaz, and O. Ghattas, Contact-coupled axisymmetric model of a cementless acetabular implant, *Proceedings of the 6th Annual International ANSYS Conference*, Pittsburgh, PA, May 1994.
18. X. Li, J. Bielak, and O. Ghattas, Seismic response in a three-dimensional basin on a CM-2, *Proceedings of the Eighth International Conference of the International Association for Computer Methods and Advances in Geomechanics*, Morgantown, WV, May 1994.
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20. C.E. Orozco and O. Ghattas, Optimal design of systems governed by nonlinear partial differential equations, *Proceedings of the Fourth Symposium on Multidisciplinary Analysis and Optimization*, pp. 1126–1140, Cleveland, OH, September 1992.
21. X. Li, J. Bielak, and O. Ghattas, Three-dimensional earthquake site response on a CM-2, in *Proceedings of the Tenth World Conference on Earthquake Engineering*, pp. 959–964, Madrid, Spain, July 1992.

22. O. Ghattas and S.K. Schrader, Optimal topologies of structures by nonlinear programming, *Proceedings of the NSF Grantees Conference on Design and Manufacturing Systems*, Atlanta, GA, January 1992.
23. O. Ghattas and I.E. Grossmann, MINLP and MILP strategies for discrete sizing structural optimization problems, *Proceedings of the Tenth ASCE Conference on Electronic Computation*, pp. 197–204, Indianapolis, IN, April 1991.
24. C.E. Orozco and O. Ghattas, Jacobian and Hessian sparsity in simultaneous and nested structural optimization, *Proceedings of the 32nd Structures, Structural Dynamics, and Materials Conference*, pp. 413–423, Baltimore, MD, April 1991.
25. O. Ghattas and S.C. Jang, Computational strategies for large-scale structural inverse problems, *Proceedings of the 32nd Structures, Structural Dynamics, and Materials Conference*, pp. 1475–1486, Baltimore, MD, April 1991.
26. G.M. Turkiyyah and O. Ghattas, Systematic shape parameterization in design optimization, *Sensitivity Analysis and Optimization with Numerical Methods*, S. Saigal and S. Mukherjee, eds., ASME AMD-Vol. 115, 1990.
27. O. Ghattas and R.J. Melosh, Structural optimization of stress-constrained indeterminate trusses as a linear programming problem, *Proceedings of the 31st Structures, Structural Dynamics and Materials Conference*, pp. 334–344, Long Beach, CA, May 1990.

E. Other Writings

1. O. Ghattas, *Scalable Parallel Algorithms for Inverse Problems in Subsurface Modeling*, white paper commissioned by organizers for DOE Office of Science Workshop on Computational Subsurface Sciences, March 2007.
2. D. Maidment, O. Ghattas, B. Hodges, L. Kallivokas, *An Integrated Simulation Framework for Near-Real Time Continental Water Dynamics Modeling*, University of Texas at Austin, 2006.
3. B. van Bloemen Waanders (ed.), B. Bader, R. Bartlett, J. Berry, R. Bilisoly, P. Boggs, R. Carr, S. Collis, A. Cooper, A. Draganescu, G. Hammond, W. Hart, J. Hill, S. McKenna, P. Lin, K. Long, S. Margolis, C. Peyton, C. Phillips, M. Sala, A. Salinger, J. Shadid, C. Silva, R. Tuminaro, V. Tidwell, B. van Bloemen Waanders, J. Watson, L. Yarrington, V. Akcelik, L. Biegler, G. Biros, S. Buchberger, S. Bujanda, O. Ghattas, H. Greenberg, P. Howard, R. Janke, G. Konjevod, C. Laird, E. Lauer, Z. Li, H. Lin, R. Murray, J. Uber, K. Willcox, *Algorithm and Simulation Development in Support of Response Strategies for Contamination Events in Air and Water Systems*, Sandia Report SAND2006-0074, January 2006.
4. O. Ghattas, PDE-constrained optimization, *SIAM News*, July 2005.
5. B. G. van Bloemen Waanders, R. A. Bartlett, S.S. Collis, E.R. Keiter, C.C. Ober, T.M. Smith, V. Akcelik, O. Ghattas, J.C. Hill, M. Berggren, M. Heinkenschloss, L.C. Wilcox, Sensitivity Technologies for Large Scale Simulation, Sandia Report SAND2004-6574, January, 2005.
6. G. Biros and O. Ghattas, A Lagrange–Newton–Krylov–Schur Method for PDE-Constrained Optimization, in *SIAG/OPT Views-and-News*, v.11, Aug. 2000, newsletter of the SIAM Activity Group on Optimization, special issue on PDE-constrained optimization.
7. M.K. Blackwell, A.M. DiGioia III, O. Ghattas, B. Jaramaz, B. John, L.F. Kallivokas, T. Kanade, F. Morgan, R.V. O’Toole, D.A. Simon, H. Tabachneck and C. Visnic, Planning, simulation, and execution of robot-assisted surgery in orthopaedics, *Robotics and Machine Perception, SPIE’s International Technical Working Group Newsletter, Special Issue on Robotics for Biomedical Applications*, Vol. 4 (1), p. 8, April 1995.
8. O. Ghattas, B. He, and J.F. Antaki, Shape optimization of Navier-Stokes flows with application to optimal design of artificial heart components, EDRC Technical Report, 1995.
9. O. Ghattas and X. Li, Sensitivity analysis of nonlinear fluid-solid interaction, EDRC Technical Report, 1995.

10. A.M. DiGioia, R.H. Reid, B. Jaramaz, and O. Ghattas, Mechanics of press-fit femoral implants, Technical Report 94-101, Center for Orthopaedic Research, Shadyside Hospital, 1994.
11. O. Ghattas and C.E. Orozco, Highly parallel reduced SQP methods for shape optimization, EDRC Technical Report, 1993.
12. C.E. Orozco and O. Ghattas, Massively parallel aerodynamic shape optimization, EDRC Technical Report, 1992.
13. C.E. Orozco and O. Ghattas, A sparse approach to simultaneous analysis and design of geometrically-nonlinear structures, EDRC Technical Report, 1991.
14. O. Ghattas and P.K. Haff, Stochastic design of novel optical systems, report to Army Research Office, 1989.
15. O. Ghattas, Structural optimization of indeterminate trusses as a linear programming problem, Ph.D. Thesis, Department of Civil and Environmental Engineering, Duke University, Durham, NC, 1988.
16. O. Ghattas, Integer programming formulation and solution of the minimum bandwidth problem, M.S. Thesis. Department of Civil and Environmental Engineering, Duke University, Durham, NC, 1986.

4 Grants and Contracts

A. Awarded to date

1. J. Boisseau, principal investigator; O. Ghattas, K. Schulz, and T. Minyard, co-principal investigators, *World-Class Science Through World Leadership in HPC*, National Science Foundation, cooperative support agreement OCI-0622780, 10/1/06–9/30/11, \$58,930,229.
2. J. Bielak, principal investigator; J. Steidl, L. Kallivokas, L. Velazquez, and D. Asimaki, co-principal investigators; O. Ghattas, K. Stokoe, M. Argaez, senior investigators, *NEESR-SG: High-fidelity site characterization by experimentation, field observation, and inversion-based modeling*, National Science Foundation, grant CMS-0619078, 10/1/06–9/30/10, total \$1,480,000, UT-Austin portion \$508,393.
3. O. Ghattas, principal investigator, *Towards Optimal Petascale Simulations (TOPS)*, Department of Energy, Mathematical Information, and Computational Sciences (MICS) division, Scientific Discovery Through Advanced Computation (SciDAC-2) program, cooperative agreement no. DE-FC02-06ER25782, 9/15/06–9/14/11, \$400,000. (Part of a five-year, \$15.5M SciDAC-2 center led by D. Keyes and involving Argonne National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories, University of California at Berkeley, University of Colorado at Boulder, Columbia University, and University of California at San Diego.)
4. O. Ghattas, principal investigator; M. Wheeler, C. Bajaj, J.T. Oden, and J. Boisseau, co-principal investigators, *MRI: Acquisition of a High Performance Computing System for Online Simulation*, National Science Foundation, grant CNS-0619838, 9/1/06–8/31/09, total \$800,000.
5. M. Tomasso, principal investigator; S. Fomel and O. Ghattas, co-principal investigators, *Multicomponent seismic data analysis with application to characterizing subsurface lithological variability*, Apache Corporation, 1/1/06–3/31/06, \$50,000.
6. O. Ghattas, lead principal investigator; G. Biros (Penn) and K. Willcox (MIT), principal investigators, *Collaborative Research: DDDAS-TMRP: MIPS: A Real-Time Measurement-Inversion-Prediction-Steering Framework for Hazardous Events*, National Science Foundation — Dynamic Data Driven Application Systems (DDDAS) Program, grant CNS-0540372, 10/1/05–9/30/08, total \$825,000, UT-Austin portion \$275,000. (AFOSR contributing to funding.)
7. M. Sacks, principal investigator, J. Antaki, S. Badylak, H. Borovetz, O. Ghattas, P. Leduc, D. Vorp, S. Woo, co-investigators, *Training in Biomechanics in Regenerative Medicine*, National Institute for Biomedical Imaging and Bioengineering (NIH/NIBIB), National Research Service Award Institutional Research Training Grants (T32), 5/04, \$1.4M.

8. O. Ghattas, lead principal investigator; George Biros (Penn), Eldad Haber (Emory), David Keyes (Columbia), and Jennifer Schopf (Argonne/Chicago), principal investigators; Volkan Akcelik, Christos Davatzikos (Penn), William Gropp (Argonne/Chicago), and Jan Modersitzki (Lubek), co-principal investigators; *ITR: Collaborative Research - ASE - (sim+dmc): Image-based Biophysical Modeling: Scalable Registration and Inversion Algorithms and Distributed Computing*; National Science Foundation—Information Technology Research (ITR) program, grant CCF-0427985, 9/2/04–8/31/09, total \$1,125,000, CMU portion \$242,042.
9. L. Biegler and O. Ghattas, principal investigators, *Time Dependent Contaminant Source Determination*, Sandia National Labs, 7/1/04-6/30/05, \$100,000.
10. J. Bielak (principal investigator) and O. Ghattas (co-principal investigator), *ITR/NGS: Multiresolution High Fidelity Earthquake Modeling: Dynamic Rupture, Basin Response, Blind Deconvolution Seismic Inversion, and Ultrascale Computing*, National Science Foundation, Information Technology Research program, grant ATM-0326449, 10/1/03–8/31/07, \$1,984,727. (Collaborative grant with San Diego State University and University of Texas at Austin; total is \$3.0M.)
11. L. Biegler, principal investigator, and O. Ghattas, D. Keyes, and M. Heinkenschloss, co-principal investigators, *Real-time Optimization for Data Assimilation and Control of Large Scale Dynamic Simulations*, National Science Foundation, Information Technology Research program, grant ACI-0121667, 10/1/01-8/21/06, \$2,500,000, CMU portion \$ 1,145,000.
12. O. Ghattas, principal investigator, *Terascale Optimal PDE Simulations (TOPS) Center*, Department of Energy, Mathematical, Information, and Computational Sciences (MICS) division, Scientific Discovery Through Advanced Computation (SciDAC) program, grant DE-FC02-01-ER25477, 9/15/01–9/14/06, \$644,482. (Part of a five-year, \$18M center involving Argonne National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, University of California-Berkeley, University of Colorado, Columbia University, New York University, University of Pennsylvania, and University of Tennessee.) (Grant transfer to UT-Austin with new grant no., DE-FG02-06ER25738.)
13. O. Ghattas, principal investigator, and L. Biegler, co-principal investigator, *Participation of Graduate Students in a Workshop on PDE-Constrained Optimization*, Santa Fe, New Mexico, April 4-6, 2001, National Science Foundation, Division of Advanced Computational Infrastructure and Research, grant ACI-0116984, 4/1/01–9/30/01, \$14,628.
14. O. Ghattas, principal investigator, and G. Blelloch, G. Miller, and N. Walkington, co-principal investigators, *Simulation of Flows with Dynamic Interfaces on Multi-Teraflops Computers*, National Science Foundation—Information Technology Research (ITR) program, grant ITR-0086093, 9/1/00–8/31/04, \$3,113,304.
15. D. Trotter, principal investigator, J. Bielak, B. Carter (MSU), G. Fenves (UC Berkeley), O. Ghattas, D. O'Hallaron, and B. Stojadinovic (UC Berkeley), associated investigators, *Advanced Simulation Methods for Seismic Performance of Urban Regions*, National Science Foundation grant EEC-9910786, 3/15/00–1/31/01, \$383,388.
16. O. Ghattas and L. Biegler, principal investigators *Terascale Simulation-Constrained Optimization*, Computer Science Research Institute, Sandia National Laboratories, 6/28/00–12/31/04, \$269,260.
17. J. Bielak, principal investigator, and O. Ghattas, D. O'Hallaron, S. Day, and J. Shewchuk, co-principal investigators, *Large-Scale Inversion-Based Modeling of Complex Earthquake Ground Motion in Sedimentary Basins*, National Science Foundation, Knowledge and Distributed Intelligence (KDI) Program, grant CMS-9980063, 9/1/99-8/31/03, \$2,131,000.
18. O. Ghattas, principal investigator, and L. Biegler, co-principal investigator, *Computational Design of Artificial Organs*, Pennsylvania Infrastructure Technology Alliance grant to Carnegie Mellon University, 9/1/98–8/31/99, \$51,234.
19. O. Ghattas, *Novel Scalable Algorithms for Aerospace Design Optimization on Massively Parallel Computers*, National Aeronautical and Space Administration, grant NAG-1-2090, 9/1/98–8/31/01, \$276,404.

20. O. Ghattas, principal investigator, and L. Biegler, co-principal investigator, *Parallel Algorithms for Large-Scale Simulation-Based Optimization*, National Science Foundation/Sandia National Laboratories, grant ECS-9732301, 9/1/98-8/31/02, \$754,230.
21. T. Mowry, principal investigator, and O. Ghattas, D. O'Hallaron, and J. Shewchuk, co-principal investigators, *Application-Specific Supercomputing*, NASA Ames Research Center, 1/1/98-12/31/01, \$2,405,499.
22. T. Kanade, A. DiGioia, and O. Ghattas, *Toward a Research Agenda and Infrastructure Development in Computer Assisted Diagnosis and Therapy*, Spring 1996; Bristol, England, National Science Foundation, grant BES-9521719, 4/15/95-3/31/96, \$50,000.
23. T. Kanade, principal investigator, and O. Ghattas, A. DiGioia, and B. Jaramaz, co-principal investigators, *High Performance Computing for Simulation, Planning, and Execution of Robot-Assisted Surgery*, National Science Foundation, National Challenges Program, grant ECS-9422734, 10/1/94-9/30/97, \$1,799,768
24. O. Ghattas, principal investigator, *Mechanics of Interference Fit in Total Hip Replacement*, National Science Foundation, grant BES-9412503, 9/1/94-8/31/97, \$148,811.
25. J. Bielak, principal investigator, and O. Ghattas, T. Gross, and D. O'Hallaron, co-principal investigators, *Earthquake Ground Motion Modeling in Large Basins*, National Science Foundation, Grand Challenges Program, grant CMS-9318163, 9/1/93-2/28/98, \$2,154,000.
26. O. Ghattas and J. Bielak, principal investigators, *Computational Methodologies for Coupled Non-linear Field Problems*, Algor, Inc., 5/1/93-4/30/98, \$821,142.
27. J. Bielak and O. Ghattas, principal investigators, *A Computational Mechanics Research Laboratory*, National Science Foundation, grant CMS-9212819, 9/15/92-2/28/94, \$72,000.
28. O. Ghattas, principal investigator, and G.M. Turkiyyah, co-principal investigator, *A Combined Geometric Reasoning/Numerical Optimization Methodology for Three-Dimensional Shape Synthesis*, National Science Foundation, grant DMI-9114678, 9/1/91-8/31/93, \$124,171.
29. J. Bielak, principal investigator, and O. Ghattas and G.M. Turkiyyah, co-principal investigators, *Modeling Earthquake-Induced Ground Motions in Sedimentary Basins Using Massively-Parallel Computers*, National Science Foundation Grant CMS-9110439, 4/1/91-9/30/92, \$34,895.
30. O. Ghattas, principal investigator, *Research Initiation: Structural Design Optimization as a Linear Programming Problem*, National Science Foundation, grant DMI-9009597, 6/1/90-5/31/92, \$80,000.
31. O. Ghattas, *Methodologies for Large-Scale Shape Optimization*, Engineering Design Research Center, a National Science Foundation Engineering Research Center, grant EEC-8943164, 5/1/90-4/30/97, \$316,119.

5 Professional Activities

A. Invited Talks (Plenary, Minisymposium, Workshop, and University)

1. Title TBA, minisymposium on Petaflops Applications in Computational Mechanics, in honor of JT Oden's 70th birthday, 9th USNCCM, San Francisco, July 23-26, 2006. (Invited symposium)
2. Title TBA, ICIAM 07 (Invited minisymposium)
3. Title TBA, *Applied Inverse Problems 2007*, Vancouver, Canada, June 25-29, 2007. (Invited plenary)
4. Large-scale inverse earthquake modeling, *Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN) 2007*, Crete, Greece, June 13-15, 2007. (Invited keynote)
5. Hessian-based model reduction for data assimilation, *7th International Conference on Computational Science*, Beijing, China, May 28-30, 2007. (Invited workshop)

6. Prospects for Earthquake Inversion on Petaflops Systems, *4th European SPICE workshop*, Cargese, Corsica, May 14–18, 2007. (Invited workshop)
7. Prospects for Full Waveform Earthquake Inversion on Petaflops Computers, *HPCS 2007*, Saskatoon, Saskatchewan, Canada, May 13-16, 2007. (Invited keynote)
8. Full waveform elastodynamic-based earthquake inversion on terascale supercomputers, *SIAM Conference on Mathematical and Computational Issues in the Geosciences*, Santa Fe, NM, March 19-22, 2007. (Invited plenary)
9. Panel on research directions in computational geosciences, *SIAM Conference on Mathematical and Computational Issues in the Geosciences*, Santa Fe, NM, March 19-22, 2007. (Invited panelist)
10. Panel on CS&E Programs and Disciplinary Degree Programs, *SIAM Conference on Computational Science and Engineering*, Costa Mesa, CA, February 19-23, 2007. (Invited panelist)
11. Forward and Inverse Earthquake Modeling on Parallel Computers, *Nonlinear Dynamics Seminar*, Department of Physics, University of Texas at Austin, January 29, 2007.
12. Geosciences, Society, and Supercomputing, *Jackson School of Geosciences Fall 2006 Commencement Address*, University of Texas at Austin, December 9, 2006.
13. End-to-end sensing, inversion, prediction, and control for HPC applications, *DDDAS Birds-of-a-Feather Session*, SC06, Tampa, Florida, November 14, 2006.
14. Multigrid preconditioners for ill-posed inverse problems, *2006 International Workshop on Collaboration between Numerical Methods and Large-Scale Scientific Computation*, University of Tokyo, Tokyo, Japan, October 25, 2006. (Invited workshop)
15. Toward forward and inverse earthquake modeling on petaflop computers, *1st International Symposium for Integrated Predictive Simulation System for Earthquake and Tsunami Disaster*, University of Tokyo, Tokyo, Japan, October 23–24, 2006. (Invited symposium)
16. Large-scale inverse transport: Multigrid methods and uncertainty quantification, *SIAM Annual Meeting*, Boston, MA, July 10–14, 2006. (Invited minisymposium)
17. Peering into the earth: Full waveform elastodynamic-based earthquake inversion on terascale supercomputers, *VECPAR 2006: The 7th International Meeting on High Performance Computing for Computational Science*, Rio de Janeiro, Brazil, July 10-12, 2006. (Invited plenary)
18. Large-scale parallel octree-based forward and inverse seismic wave propagation modeling, *SEAM Consortium Meeting*, Houston, TX, April 18, 2006.
19. Opportunities and challenges for petascale inverse earthquake modeling, *George Tech/Oak Ridge National Laboratories Distinguished Lecture Series*, Atlanta, GA, April 7, 2006.
20. Opportunities and challenges for earthquake inversion at the petascale, *Petascale Computing and the Geosciences Workshop*, San Diego Supercomputing Center and University of California at San Diego, San Diego, CA, April 4–5, 2006.
21. Full waveform elastodynamic-based earthquake inversion: A challenge for petascale computing, *Scientific Computing Seminar*, Institute for Theoretical and Engineering Science, Department of Mathematics, University of Houston, Houston, TX, March 22, 2006.
22. Towards petascale earthquake inversion, *Dagstuhl Workshop on Architectures and Algorithms for Petascale Computing*, Saarbrücken, Germany, February 12–17, 2006. (Invited workshop)
23. Large-scale inverse wave propagation, *ICES Forum*, Institute for Computational Engineering and Sciences, University of Texas at Austin, Austin, TX, February 10, 2006.
24. Algorithms for large-scale inverse problems and prospects for application to control and inversion of contaminant transport in porous media, *Hydrogeology Brown Bag Seminar*, Department of Geological Sciences, University of Texas at Austin, Austin, TX, January 27, 2006.
25. Computational Issues in Full Waveform Inversion and Image Registration, *Apache Corporation*, Houston, TX, December 13, 2005.
26. Large scale inverse earthquake modeling on terascale supercomputers, *Pittsburgh Supercomputing Center booth talk*, SC2005, Seattle, WA, November 15, 2005.

27. Real-time identification of atmospheric contaminants, *Workshop on Control of Complex Fluids*, Research Institute for Computational and Applied Mathematics, Linz, Austria, October 10–14, 2005.
28. Large-Scale Inverse Earthquake Modeling, *Exploration Geophysics Seminar*, Department of Geological Sciences, University of Texas at Austin, Austin, TX, October 6, 2006.
29. A PDE-Constrained Optimization Approach to Large-Scale Earthquake Inversion, *Distinguished Speaker Series in Computation for Design and Optimization*, Massachusetts Institute of Technology, September 14, 2005.
30. Optimization of Systems Governed by PDEs: Parallel Algorithms and Applications in Inverse Earthquake Modeling, *US National Congress on Computational Mechanics*, Austin, TX, July 24–28, 2005. (Invited plenary)
31. An optimal control approach to elastic image registration, *SIAM Conference on Control and its Applications*, New Orleans, LA, July 11–14, 2005. (Invited minisymposium)
32. Optimization of Systems Governed by PDEs: Algorithms and Applications in Computational Science and Engineering *DOE Scientific Discovery through Advanced Computing (SciDAC) 2005 Conference*, San Francisco, CA, June 26–30, 2005. (Invited plenary)
33. Large-scale Earthquake Inversion, *SIAM Conference on Optimization*, Stockholm, Sweden, May 15–19, 2005. (Invited plenary)
34. Inverse problems in computational cardiac electromechanics, *SIAM Conference on Optimization*, Stockholm, Sweden, May 15–19, 2005. (Invited minisymposium)
35. PDE-constrained Optimization: Algorithms and Applications, Stanford University, Institute for Computational and Mathematical Engineering, March 31, 2005.
36. Cyberinfrastructure-enabled simulation-based optimization: opportunities and challenges *NSF Workshop on Cyberinfrastructure in Engineering Design*, Arlington, VA, February 28 – March 1, 2005. (Invited workshop)
37. Challenges in Optimization of Multiscale Systems, *Sandia Computer Science Research Institute Workshop on Multiscale Mathematics*, Albuquerque, New Mexico, December 13–15, 2004. (Invited workshop)
38. Image-based elastic registration for patient-specific finite element model generation, *Special Session on PDE-Based Methods in Imaging and Vision, American Mathematical Society Fall Eastern Section Meeting*, Pittsburgh, PA, November 6–7, 2004. (Invited special session)
39. Multiscale Earthquake Inversion, Mathematics Department Colloquium, University of Pittsburgh, September 24, 2004.
40. Challenges in Multiscale Optimization, *Third DOE Workshop on Multiscale Mathematics*, September 21, 2004, Portland, Oregon. (Invited workshop)
41. Scalability Issues in Multiscale Computation, *Third DOE Workshop on Multiscale Mathematics*, September 21, 2004, Portland, Oregon. (Invited workshop)
42. A level-set fictitious domain Newton method for shape optimization, *Conference on PDEs, Scientific Computing and Optimization in Applications*, Trier, Germany, September 8–10, 2004. (Invited plenary)
43. Multiscale Optimization for Inverse Earthquake Modeling, *SIAM Annual Meeting*, Portland, OR, July 12–16, 2004. (Invited minisymposium)
44. Large-scale geophysical inversion, *Summer School on Mathematical Geophysics and Uncertainty in Earth Models*, Golden, CO, June 14–25, 2004. (Invited lecturer)
45. Simulation-based engineering science: from design to decision-making, *NSF Engineering Directorate ITR meeting*, Crystal City, VA, June 11, 2004.
46. Parallel algorithms for CFD-based optimal control and shape optimization, *Parallel CFD 2004*, Gran Canaria, Canary Islands, May 24–27, 2004. (Invited minisymposium)

47. Image-based Deformable Registration for Patient-Specific Surgical Simulation, *SIAM Conference on Imaging Science*, Salt Lake City, UT, May 2-4, 2004. (Invited minisymposium)
48. Multiscale Newton-Krylov Methods for Inverse Earthquake Modeling on Terascale Computers, Institute for Computational Engineering and Sciences seminar, University of Texas at Austin, April 13, 2004.
49. Simulation of Flows with Dynamic Interfaces on Terascale Computers, *NSF Shared Cyberinfrastructure PI Meeting*, Arlington, VA, February 18-20, 2004.
50. Optimization of time-dependent PDE systems: Challenges and opportunities, *Oberwolfach Workshop on Instationary Control*, Oberwolfach, Germany, January 18-24, 2004. (Invited workshop)
51. Saddle point problems in PDE-constrained optimization, *Sandia Computer Science Research Institute Workshop on Saddle Point Methods*, Santa Fe, December 6, 2003. (Invited workshop)
52. Multiscale methods for inverse earthquake modeling, Applied Mathematics Colloquium, Department of Applied Physics and Applied Mathematics, Columbia University, September 23, 2003.
53. Eulerian methods for shape optimization, *Workshop on Nonlinear Solvers*, Lawrence Livermore National Laboratory, August 8, 2003. (Invited workshop)
54. Multiscale methods for inverse wave propagation, *15th International Conference on Domain Decomposition Methods*, Berlin, Germany, July 24, 2003. (Invited plenary)
55. Multiscale methods for seismic inversion, *ASCE 16th Engineering Mechanics Conference*, Seattle, Washington, July 18, 2003. (Invited plenary)
56. Eulerian methods for shape optimization, *Scientific Computing and Differential Equations (SciCADE 2003)*, Trondheim, Norway, July 1, 2003. (Invited minisymposium)
57. Inverse earthquake modeling on terascale computers, *Scientific Computing and Differential Equations (SciCADE 2003)*, Trondheim, Norway, June 30, 2003. (Invited plenary)
58. Large-scale PDE-constrained optimization: Parallel algorithms and applications to inverse earthquake modeling, Computational Science and Engineering Program, University of California, Santa Barbara, May 29, 2003.
59. Towards forward and inverse earthquake modeling on petaflops computers, *Center for Computational Sciences*, University of Kentucky, Lexington, KY, April 23, 2003.
60. Forward and inverse earthquake modeling on terascale computers, *Computational Science Seminar*, College of William and Mary, Williamsburg, VA, April 7, 2003.
61. NSF/SIAM Workshop on Computational Science and Engineering, Mathematics, and Computer Science, Arlington VA, March 24, 2003. (Invited panelist)
62. Multiscale methods for inverse seismic wave propagation, *Center for Nonlinear Analysis Seminar*, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, February 27, 2003.
63. Newton-Krylov methods for seismic inversion, *Oberwolfach Workshop on Numerical Techniques for Optimization with PDE Constraints*, Oberwolfach, Germany, February 17, 2003. (Invited workshop)
64. Parallel preconditioned Newton-Krylov methods for inverse wave propagation, *SIAM Conference on Computational Science and Engineering*, San Diego, CA, February 12, 2003. (Invited minisymposium)
65. Large-scale source and material inversion for earthquake ground motion modeling, *SIAM Conference on Computational Science and Engineering*, San Diego, CA, February 10, 2003. (Invited minisymposium)
66. Introduction to PDE constrained optimization, *Workshop on Optimization in Simulation-Based Models*, Institute for Mathematics and Its Applications, University of Minnesota, Minneapolis, MN, January 7, 2003.
67. Terascale forward and inverse earthquake modeling, *Pittsburgh Supercomputing Center Booth talk*, SC2002, November 19, 2002.

68. Towards inverse earthquake modeling, *President's Distinguished Lecture on Information Technology*, Rensselaer Polytechnic Institute, Troy, NY, October 11, 2002.
69. Towards petascale forward and inverse earthquake modeling, *UK-US Workshop on Petascale Computing*, London, UK, October 1, 2002. (Invited workshop)
70. Parallel multiscale Newton Krylov methods for inverse wave propagation, *SIAM Conference on Optimization*, Toronto, Canada, May 20, 2002. (Organized workshop)
71. Scalable Newton Krylov methods for inverse wave propagation, *Workshop on Inverse Problems and Uncertainty*, Institute for Mathematics and Its Applications, University of Minneapolis, Minneapolis, MN, April 26, 2002. (Invited workshop)
72. Dynamic meshes, dynamic interfaces, and hemodynamics, *Computational Science and Engineering Symposium*, University of Illinois, Urbana-Champaign, IL, April 16, 2002. (Keynote)
73. Dynamic meshes, dynamic interfaces, and hemodynamics, *Scientific Computing Seminar Series*, Brown University, Providence, RI, April 5, 2002.
74. Multiscale methods for inverse wave propagation, *Robert J. Melosh Medal Competition for Best Student Paper in Finite Elements*, Duke University, Durham, NC, March 29, 2002.
75. Multiscale Newton-Krylov methods for inverse wave propagation, *Copper Mountain Conference on Iterative Methods*, Copper Mountain CO, March 25, 2002. (Invited session)
76. Multiscale Newton-Krylov methods for inverse wave propagation, *Applied Mathematics Seminar*, University of Colorado, Boulder CO, March 22, 2002.
77. Multiscale Newton-Krylov methods for inverse wave propagation, *Computer Science Research Institute Seminar*, Sandia National Laboratories, Albuquerque, NM, February 27, 2002.
78. Dynamic meshes, dynamic interfaces, and hemodynamics, *Computer Science Research Institute seminar*, Sandia National Laboratories, Livermore, CA, January 21, 2002.
79. Multiscale domain decomposition methods for inverse wave propagation, *Domain Decomposition 14*, Cocoyoc, Mexico, January 11, 2002. (Invited session)
80. Workshop on Sensitivity Analysis, Lawrence Livermore National Laboratory, Livermore, CA, August 16-17, 2001.
81. Lagrange-Newton-Krylov-Schur methods for optimal control of systems governed by PDEs, *SIAM Conference on Control and its Applications*, San Diego, CA, July 13, 2001. (Invited minisymposium)
82. Adjoint Newton-Krylov algorithms for optimization of time-dependent PDE systems, *SIAM Conference on Control and its Applications*, San Diego, CA, July 11, 2001. (Invited minisymposium)
83. Dynamic meshes, dynamic interfaces, and hemodynamics, *Center for Advanced Scientific Computing Seminar*, Lawrence Livermore National Laboratory, Livermore, CA, July 2, 2001.
84. Dynamic meshes, dynamic interfaces, and hemodynamics, *Computer Science Research Institute*, Sandia National Laboratories, Albuquerque, NM, June 27, 2001.
85. PDE-constrained optimization as an enabling technology for dynamic data-driven application systems, *International Conference on Supercomputing*, Sorrento, Italy, June 20, 2001. (Invited panel)
86. Dynamic meshes, dynamic interfaces, and hemodynamics, *Institute for Terascale Simulation Seminar*, Lawrence Livermore National Laboratory, Livermore, CA, June 13, 2001.
87. Parallel Newton-Krylov algorithms for large-scale PDE-constrained optimization, *Scientific Computing and Computational Mathematics Seminar*, Stanford University, Stanford, CA, May 14, 2001.
88. Algorithmic challenges for PDE-constrained optimization, *First Sandia Workshop on PDE-Constrained Optimization*, Santa Fe, NM, April 4, 2001.
89. Parallel Newton-Krylov methods for PDE-constrained optimization, *SIAM Conference on Parallel Processing for Scientific Computing*, Norfolk, VA, March 12, 2001. (Invited minisymposium)

90. Dynamic Meshes, Dynamic Interfaces, and Hemodynamics *Courant Institute for Mathematical Sciences Seminar*, New York University, NY, March 9, 2001.
91. Large-scale PDE-constrained optimization: Newton-Krylov algorithms and applications to optimal flow control and seismic inversion, *7th US-Mexico Workshop in Numerical Analysis*, Merida, Mexico, January 8, 2001. (Invited workshop)
92. Earthquake modeling on terascale computers, *Pittsburgh Supercomputing Center Booth*, Supercomputing 2000, Dallas, TX, November 8, 2000.
93. Microstructural blood flow modeling on terascale computers, *Pittsburgh Supercomputing Center Booth*, Supercomputing 2000, Dallas, TX, November 8, 2000.
94. Parallel algorithms for large-scale PDE-constrained optimization, *SIAM Conference on Computational Science and Engineering*, September 23, 2000, Washington, DC. (Invited minisymposium)
95. Multiprocessor computing: A shift in the optimization paradigm? *AIAA Symposium on Multidisciplinary Analysis and Optimization*, Long Beach, CA, September 6, 2000. (Invited panel)
96. PDE-constrained optimization: Algorithms, software, and optimal flow control applications, *International Symposium on Mathematical Programming*, Atlanta, GA, August 11, 2000. (Invited minisymposium)
97. Large-scale PDE-constrained optimization, *Computer Science Research Institute seminar*, Sandia National Laboratories, Albuquerque, NM, August 4, 2000.
98. PDE solvers and PDE optimizers: Similarities and differences, *Lawrence Livermore National Laboratory Workshop on Nonlinear Solvers*, Pleasanton, CA, July 28, 2000. (Invited workshop)
99. Massively parallel algorithms for large-scale simulation-based optimization, NASA Langley Research Center, April 7, 2000.
100. Large-scale PDE-constrained optimization: Parallel algorithms and applications to optimal design, optimal control, and inverse problems, *Center for Applied Scientific Computing seminar*, Lawrence Livermore National Laboratory, March 29, 2000.
101. Large-scale PDE-constrained optimization: Parallel algorithms and applications to optimal design, optimal control, and inverse problems, *Computer Science Research Institute*, Sandia National Laboratories, Livermore, CA, March 24, 2000.
102. Large-scale PDE-constrained optimization: Parallel algorithms and applications to optimal design, optimal control, and parameter estimation problem, *Computational and Applied Mathematics Proseminar*, Arizona State University, Tempe, Arizona, March 6, 2000.
103. Large-scale PDE-constrained optimization, *Workshop on Computational Materials Modeling*, Carnegie Mellon University, Pittsburgh, PA, December 8, 1999.
104. Towards multiscale blood flow modeling, *Department of Mechanical Engineering Seminar*, University of Pittsburgh, Pittsburgh, PA, November 20, 1998.
105. Towards rational blood flow modeling, *Center for Medical Robotics and Computer Assisted Surgery Seminar*, Robotics Institute, Carnegie Mellon University, Pittsburgh, PA, November 11, 1998.
106. Scalability of parallel SQP algorithms for optimal design and control, *SIAM Conference on Optimization*, Atlanta, GA, May 10, 1999.
107. Towards scalable CFD-based optimization, NASA-Langley Research Center, Hampton, VA, November 6, 1998.
108. Towards rational blood flow modeling, *Center for Nonlinear Analysis Seminar*, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA, October 27, 1998.
109. Research directions in PDE-constrained optimization on multi-teraflops computers, *NSF Workshop on Algorithms for the New Millennium*, Washington, DC, July 9, 1998. (Invited workshop)
110. Algorithms for large-scale unstructured mesh computations on parallel computers, NASA Ames Research Center, Mountain View, CA, February 16, 1998.

111. Large-scale PDE-constrained optimization on parallel computers, *Institute for Computer Applications in Science and Engineering Seminar*, NASA Langley Research Center, Hampton, VA, July 29, 1997.
112. Computational issues associated with earthquake ground motion modeling, National Science Foundation, July 10, 1997.
113. Earthquake ground motion modeling on parallel computers, *Department of Mechanical Engineering Seminar*, University of Pittsburgh, December 3, 1996.
114. Parallel unstructured mesh ground motion modeling, *SCEC Workshop on Ground Motion Modeling*, San Diego, June 19, 1996. (Invited workshop)
115. Large-scale optimal design, *Workshop on Large-Scale Optimization*, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN, July 13, 1995. (Invited workshop)
116. Parallel optimal design: Algorithms and applications, *ICASE/LaRC Workshop on Multidisciplinary Design Optimization*, Hampton, VA, March 15, 1995.

B. Contributed Seminars and Talks

1. A parallel multigrid method for large scale inverse transport, *World Congress on Computational Mechanics*, Los Angeles, CA, July 16-22, 2006.
2. A parallel multigrid method for large-scale data assimilation, *SIAM Conference on Parallel Processing for Scientific Computing*, San Francisco, CA, February 22-25, 2006.
3. Dynamic data-driven inversion for terascale simulations: Real-time identification of airborne contaminants, *SC2005*, Seattle, WA, November 12-18, 2005.
4. An optimal control approach to elastic image registration, *SIAM Annual Meeting*, New Orleans, LA, July 13, 2005.
5. Parallel elastodynamic inversion for earthquake modeling, *SIAM Conference on Parallel Processing for Scientific Computing*, San Francisco, CA, February 25, 2003.
6. Terascale forward and inverse earthquake modeling, *SC2003*, Phoenix, AZ, November 19, 2003.
7. Multilevel solvers for inverse problems, *Terascale Optimal PDE Simulations Center All-Hands Meeting*, New York, NY, October 19, 2003.
8. Multilevel solvers for inverse problems, *Terascale Optimal PDE Simulations Center All-Hands Meeting*, San Diego, CA, February 13, 2003.
9. Terascale optimal PDE simulations integrated software infrastructure center (TOPS-ISIC), *DOE SciDAC Booth*, SC2002, Baltimore, MD, November 22, 2002.
10. Parallel multiscale Gauss-Newton-Krylov methods for inverse wave propagation, *SC2002*, Baltimore, MD, November 20, 2002.
11. Large-scale inversion and control for systems governed by PDEs, *Caliente Project All Hands Meeting*, Sandia National Laboratories, Albuquerque, NM, July 15, 2002.
12. Multilevel solvers for PDE constrained optimization, *Terascale Optimal PDE Simulations Center All-Hands Meeting*, Philadelphia, PA, July 10, 2002.
13. Computational biomechanics and medical devices, *Biomedical Engineering Advisory Board Meeting*, Carnegie Mellon University, Pittsburgh, PA, May 31, 2002.
14. Towards optimal solvers for PDE constrained optimization, *Terascale Optimal PDE Simulations Center All-Hands Meeting* Lawrence Livermore National Laboratory, Livermore, CA, January 25, 2002.
15. Simulation and Optimization at SNL and LLNL, *Department of Civil and Environmental Engineering Seminar*, Carnegie Mellon University, September 28, 2001.
16. Multiscale blood flow modeling on terascale computers, *Sangria Project All Hands Meeting*, McGowan Center for Artificial Organs, University of Pittsburgh Medical Center, September 29, 2001.

17. Large-scale optimization for inversion and control of dynamic simulations, *ITR Project kick-off meeting*, Pittsburgh, PA, October 20, 2001.
18. Multiscale Newton-Krylov algorithms for inverse seismic wave propagation, *Applied Inverse Problems: Theoretical and Computational Aspects*, Montecatini Terme, Italy, June 18, 2001.
19. Lagrange-Newton-Krylov-Schur methods for optimal control of Navier-Stokes flows, *Applied Inverse Problems: Theoretical and Computational Aspects*, Montecatini Terme, Italy, June 18, 2001.
20. A multiscale approach to inverse wave propagation, *Symposium on Advanced Multiscale and Multiresolution Methods*, Yosemite National Park, California, October 31, 2000.
21. Blood flow modeling on teraflops computers, *CAE/CM seminar*, Carnegie Mellon University, September 15, 2000.
22. Scalable parallel SQP methods for optimization of viscous flows, *AIAA Symposium on Multidisciplinary Analysis and Optimization*, Long Beach, CA, September 6, 2000.
23. Seismic Inversion, *Quake Project All Hands Meeting*, Carnegie Mellon University, June 6, 2000.
24. Large-Scale Simulation-Constrained Optimization, *NSF/Sandia LCE Program Review*, Albuquerque, March 3, 2000.
25. Parallel domain decomposition methods for optimal control of viscous incompressible flows, *Parallel CFD 1999*, Williamsburg, VA, May 23, 1999.
26. Computational design of artificial organs, *Institute for Complex Engineered Systems Seminar*, Carnegie Mellon University, May 4, 1999.
27. Terascale algorithms for optimization of simulations, *NSF/Sandia LCE Program Review*, Sandia National Laboratories, Albuquerque, NM, March 18, 1999.
28. The graduate program in computational mechanics in Civil and Environmental Engineering at CMU, *Civil and Environmental Engineering State-of-the-Art Workshop*, Carnegie Mellon University, July 13, 1998.
29. Earthquake ground motion modeling in large heterogeneous basins on parallel computers, *Fourth U.S. National Congress on Computational Mechanics*, San Francisco, CA, August 8, 1997.
30. Large-scale optimization on parallel computers, *Synthesis Lab Seminar*, Engineering Design Research Center, Carnegie Mellon University, July 7, 1997.
31. Modeling seismic wave propagation in large basins on parallel computers, *Fourth SIAM Conference on Mathematical and Computational Issues in the Geosciences*, Albuquerque, NM, June 18, 1997.
32. Earthquake ground motion modeling in large heterogeneous basins on parallel computers, *Eighth SIAM Conference on Parallel Processing for Scientific Computing*, Minneapolis, MN, March 15, 1997.
33. Shape optimization of Navier-Stokes flows, *SIAM Conference on Optimization*, Victoria, BC, May 22, 1996.
34. Sensitivity analysis of nonlinear fluid-solid interaction, *Third U.S. National Congress on Computational Mechanics*, Dallas, TX, June 12, 1995.
35. Finite elements in one lecture, *Medical Robotics and Computer-Assisted Surgery seminar*, Carnegie Mellon University, April 14, 1995.
36. Fictitious domain methods for biomechanics simulation, *Medical Robotics and Computer-Assisted Surgery Retreat*, Hidden Valley, PA, March 17, 1995.
37. Variational methods for nonlinear fluid-solid interaction, *Twelfth U.S. National Congress of Applied Mechanics*, Seattle, WA, July 1994.
38. Towards optimal design of artificial hearts, *Workshop on Optimal Design and Control*, Blacksburg VA, April 1994.
39. Variational methods and domain decomposition for nonlinear fluid-structure interaction, *Seventh International Conference on Domain Decomposition Methods*, State College, PA, October 1993.

40. A variational approach to aeroelasticity and its sensitivity analysis, *Second U.S. National Congress on Computational Mechanics*, Washington, DC, August 1993.
41. Some optimization problems in biomechanics, *Center for Medical Robotics and Computer-Assisted Surgery*, Carnegie Mellon University, May 1993.
42. Adaptive methods for partial differential equations, *Scientific Computing Seminar*, Department of Computer Science, Carnegie Mellon University, March 1993.
43. SQP methods for shape optimization on the CM-2, *Second Symposium on Parallel Computational Methods for Large-Scale Structural Analysis and Design*, Norfolk, VA, February 1993.
44. Optimal design of aerospace vehicles, *Synthesis Lab Seminar*, Engineering Design Research Center, Carnegie Mellon University, October 1992.
45. Massively parallel algorithms for optimal design of engineering systems, *SIAM Conference on Optimization*, Chicago, May 1992.
46. Shape optimization on data-parallel computers, *Synthesis Lab Seminar*, Engineering Design Research Center, Carnegie Mellon University, October 16, 1991.
47. Multilevel adaptive finite element solution of problems in linear elastostatics, *First U.S. National Congress on Computational Mechanics*, Chicago, July 24, 1991.
48. Computational strategies for large-scale structural inverse problems, *Structural and Computational Mechanics Seminar*, Department of Civil Engineering, Carnegie Mellon University, September 14, 1990.
49. Current research in shape optimization, *Synthesis Lab Seminar*, Engineering Design Research Center, Carnegie Mellon University, March 8, 1990.
50. Optimal topologies and optimal trusses, *Synthesis Lab seminar*, Engineering Design Research Center, Carnegie Mellon University, September 13, 1989.

C. Recent organized minisymposia

1. PDE-Constrained Optimization I–VI, *SIAM Conference on Computational Science and Engineering*, Costa Mesa, CA, Feb 19–23, 2007.
2. Frontiers of Parallel PDE-Constrained Optimization I, II, and III, *12th SIAM Conference on Parallel Processing for Scientific Computing*, February 22–24, 2006.
3. Parallel Mesh Generation I, II, and III, *12th SIAM Conference on Parallel Processing for Scientific Computing*, San Francisco, CA, February 22–24, 2006.
4. Optimization of Systems Governed by PDEs, *Joint Congress of the Austrian and German Mathematical Societies*, Klagenfurt, Austria, September 18–23, 2005.
5. Computational Cardiology I and II, *SIAM Annual Meeting*, New Orleans, LA, July 11–15, 2005.
6. Recent Advances in Seismic Inversion I and II, *Seismological Society of America 2005 Annual Meeting*, Lake Tahoe, NV, April 27–29, 2005.
7. Large-scale PDE-constrained Optimization I, II, and III, *3rd SIAM Conference on Computational Science and Engineering*, Orlando, FL, February 11–15, 2005.
8. Domain Decomposition Methods for PDE-constrained Optimization, *16th International Conference on Domain Decomposition Methods*, Courant Institute, New York University, New York, NY, January 12–15, 2005.
9. Frontiers of Parallel PDE-Constrained Optimization I, II, and III, *11th SIAM Conference on Parallel Processing for Scientific Computing*, February 25–27, 2004.

D. Government committees

1. Numerous review panels for NSF programs in Computer and Information Science and Engineering (CISE), Engineering (ENG), and Mathematical and Physical Sciences (MPS) Directorates

2. Review panel, NSF-Partnerships for Advanced Computational Infrastructure Program (NCSA and NPACI), 8/98–8/01.
3. Review panel, Center for the Simulation of Advanced Rockets, University of Illinois, Department of Energy Accelerated Strategic Computing Initiative–Academic Strategic Alliances Program, 2000, 2001, 2003, 2005.

E. Recent Professional Activities

1. International Scientific Committee, *International Conference on Engineering Optimization*, Rio de Janeiro, June 2–5, 2008.
2. Program Committee, 2008 International Parallel and Distributed Processing Symposium (IPDPS), Miami, Florida, April 2008.
3. Editorial Board, *Inverse Problems*, 2007–2008.
4. Editorial Board, *The Open Applied Mathematics Journal*, 2007–
5. Editorial Board, *Advances in Computational Science and Technology*, 2007–
6. Site Characterization and Model Calibration Panel Co-Leader, DOE Office of Science Workshop on Computational Subsurface Sciences, Bethesda, Maryland, January 9–12, 2007.
7. Guest Editor, *Inverse Problems*, Special Issue on Computational Inverse Problems and Uncertainty, 2007.
8. Guest Editorial Board, *SIAM Journal on Scientific Computing*, Special Issue on Computational Science & Engineering, 2007.
9. Area Chair for Applications, *SC07 Technical Program Committee*, Reno, Nevada, November 2007.
10. SIAM Ad Hoc Committee on Proceedings, 2006–2007.
11. Editorial Board, *Far-East Journal of Mathematics*, 2006–
12. Editorial Board, *Mathematical Modeling and Applied Computing*, 2006–
13. Technical Advisory Board, *9th US National Congress on Computational Mechanics*, San Francisco, CA, July 22–26, 2007.
14. International Advisory Board, *ECCOMAS Conference on Computational Methods in Structural Dynamics and Earthquake Engineering*, Crete, Greece, June 13–15, 2007.
15. Scientific Advisory Board, Seventh World Congress on Computational Mechanics, Los Angeles, California, USA, July 16–22, 2006.
16. Program Committee, *Workshop on Advances in Continuous Optimization*, Reykjavik, Iceland, June 30–July 1, 2006.
17. Member of Organizing Committee, *SIAM Conference on Parallel Processing for Scientific Computing*, February 22–25, 2006.
18. Associate Editor, *SIAM Journal on Scientific Computing*, 2005–
19. Member of the Science Steering Committee, Computational Infrastructure for Geodynamics (CIG), 2005–
20. Co-organizer, *Sandia Workshop on Large Scale Robust Optimization*, Santa Fe, NM, August 31–September 2, 2005.
21. Editorial Board, *Computer Methods in Applied Mechanics and Engineering*, 01/05–present.
22. International Scientific Committee, *6th World Conference on Structural and Multidisciplinary Optimization (WCSMO6)*, Rio de Janeiro, May 30–June 3, 2005.
23. Member of Organizing Committee, *SIAM Conference on Computational Science and Engineering*, Orlando, FL, February 11–15, 2005.
24. Co-organizer, *Second Sandia Workshop on PDE-Constrained Optimization*, Santa Fe, NM, May 19–22, 2004.

25. Member, SIAM Program Committee, 2004–present.
26. Member of Organizing Committee, *SIAM Conference on Parallel Processing for Scientific Computing*, February 25–27, 2004.
27. Co-chair of Organizing Committee, *SIAM Conference on Computational Science & Engineering*, San Diego, CA, February 9–13, 2003.
28. Editor-in-Chief, *SIAM Series on Computational Science & Engineering*, 2/03–present.
29. Co-organizer, *Workshop on Optimization in Simulation-Based Models*, Institute for Mathematics and Its Applications, University of Minnesota, Minneapolis, MN, Jan 7–16, 2003.
30. Editorial Board, *Journal of Multiscale Computational Engineering*, 10/02–present.
31. SIAM representative at Coalition for the National Science Foundation annual Capitol Hill open house, May 15, 2002.
32. Program Director, *Computational Science & Engineering Special Interest Activity Group*, Society for Industrial and Applied Mathematics (SIAM), 7/01–present.
33. Co-organizer, *First Sandia Workshop on PDE-Constrained Optimization*, Santa Fe, NM, April 4–6, 2001.
34. Superchair, *Seventh AIAA Symposium on Multidisciplinary Analysis and Optimization*, St. Louis, MO, September, 1998.
35. Chair, *AIAA Multidisciplinary Design Optimization Awards Committee* (awards AIAA MDO Award and AIAA MDO Best Paper Award), 4/97–4/99
36. Member, AIAA Technical Committee for Multidisciplinary Design Optimization, 5/95–4/99

F. Awards, Prizes, Honors

1. *SC06 HPC Analytics Award*, for the entry: “Remote Runtime Steering of Integrated Terascale Simulation and Visualization,” H. Yu, T. Tu, J. Bielak, O. Ghattas, K.-L. Ma, D.R. O’Hallaron, N. Stone, R. Taborda, and J. Urbanic, IEEE/ACM SC06 Conference, Tampa, FL, Nov. 2006.
2. *Finalist, SC06 Best Student Paper Award*, for the paper: T. Tu, H. Yu, and L. Ramirez-Guzman, J. Bielak, O. Ghattas, K.-L. Ma, D.R. O’Hallaron, “From physical models to scientific visualization: An end-to-end approach to parallel supercomputing,” *Proceedings of SC06*, Tampa, FL, Nov. 2006.
3. 2004-2005 Carnegie Institute of Technology (CMU’s Engineering College) Outstanding Research Award (with V. Akcelik, J. Bielak, and D. O’Hallaron).
4. Quake Project selected for Computerworld Honors Permanent Collection (2004).
5. Finalist, 2004 Computerworld Honors 21st Century Achievement Awards (with J. Bielak and D. O’Hallaron; one of five in Science category).
6. Winner, 2003 Gordon Bell Prize for Special Accomplishment (with CMU Quake group: V. Akcelik, J. Bielak, G. Biros, E. Epanomeritakis, A. Fernandez, E. Kim, D. O’Hallaron, T. Tu, J. Urbanic)
7. Quake Project named a TeraGrid Flagship Application, 2003.
8. With former students V. Akcelik and G. Biros, received *Best Technical Paper Award* at Supercomputing 2002 for the paper “Parallel Multiscale Gauss-Newton-Krylov Methods for Inverse Wave Propagation.”
9. Judge, *Robert J. Melosh Competition for Best Student Paper in Finite Elements*, Duke University, Durham, NC, March 29, 2002.
10. Studies in Computational Tools and Mathematical Modeling for Dynamic Fluid Flows, AIAA Award for PhD advisee Ivan Malcevich’s dissertation, presented at AIAA Aerospace Sciences Conference, Reno, NV, January 2002.
11. Quake code selected as one of 14 floating point benchmarks in industry-standard SPEC CPU2000 and OpenMP2001 benchmarks.

12. Program 183.EQUAKE (earthquake ground motion modeling) selected by SPEC (Standard Performance Evaluation Corporation) as one of 14 floating point benchmarks in the SPEC CPU2000 benchmark suite.
13. Parallelized versions of 183.EQUAKE, called 320.EQUAKE M and 321.EQUAKE L selected for inclusion in the SPEC OMPM2001 and OMPL2001 benchmark suites for evaluating shared-memory multiprocessor system performance.
14. 1998 Allen Newell Award for Research Excellence (with CMU Quake group: H. Bao, J. Bielak, L. Kallivokas, D. O'Hallaron, J. Shewchuk, J. Xu)
15. Runnerup, 1997 Gordon Bell Prize (with CMU Quake group: H. Bao, J. Bielak, L. Kallivokas, D. O'Hallaron, J. Shewchuk, J. Xu)
16. Simulation of 1994 Northridge Earthquake Aftershock selected for SIGGRAPH 97 Electronic Theater (with CMU Quake Group)

G. Service on UT Committees

1. Mechanical Engineering Committee on Intelligent Systems Research Thrust (2/07–)
2. CAM Graduate Studies Subcommittee (3/06–3/09)
3. CAM Graduate Admissions Committee (9/05–4/06)
4. ICES Advisory Board (9/05–)
5. Jackson School of Geosciences Strategic Planning Committee (9/05–)
6. Geological Sciences Budget Council (9/05–present)
7. Geological Sciences Graduate Studies Committee (9/05–present)
8. Mechanical Engineering Budget Council (9/05–present)
9. Mechanical Engineering Graduate Studies Committee (9/05–present)

H. Service on CMU Committees

1. Computer Committee, Department of Civil Engineering (9/89–8/95)
2. Freshman Course Committee, Department of Civil Engineering (8/90–12/90)
3. Faculty Search Committee, Robotics/Civil Engineering (1/90–1/91)
4. CAE Faculty Search Committee, Department of Civil Engineering (12/90–5/91)
5. EPM Faculty Search Committee, Department of Civil Engineering (12/90–5/92)
6. ASCE Student Chapter Faculty Advisor (1/92–5/95)
7. Geoenvironmental Faculty Search Committee, Department of Civil Engineering (9/92–5/93)
8. University Committee on Special Faculty Appointments (9/94–8/97)
9. University Committee on Lecturer Track Appointments (1/95–8/98)
10. Department Head Search Committee, Department of Civil and Environmental Engineering, Fall 1995
11. Computing Strategic Planning Committee, Department of Civil and Environmental Engineering, 9/96–present
12. CAE Faculty Search Committee, Department of Civil and Environmental Engineering (5/98–5/99)
13. Computational Mechanics Faculty Search Committee, Department of Civil and Environmental Engineering (9/98–5/00)
14. Undergraduate Curriculum Committee, Department of Civil and Environmental Engineering (11/99–present)
15. Committee for Promotions and Tenure, College of Engineering (Fall 2001)
16. Faculty Senator (9/01–present)

17. 2002 Faculty Search Committee, Department of Biomedical Engineering
18. 2003 Faculty Search Committee, Department of Biomedical Engineering
19. Committee for Promotions and Tenure, College of Engineering (Fall 2003)
20. Mechanics, Materials, and Computing Faculty Search Committee, Department of Civil and Environmental Engineering (1/04–5/05)
21. Undergraduate Curriculum Committee, Department of Biomedical Engineering, chair (1/04–5/05)
22. Curriculum Review Committee, College of Engineering (1/04–5/05)
23. Curriculum Assessment Committee, College of Engineering (1/04–5/05)