

Kurt Maute

Curriculum Vitae

February 16, 2011

Associate Professor
H. Joseph Smead Fellow
Associate Chair for Undergraduate Affairs
Director, Center for Aerospace Structures
CUB Site Director, Center for Research and Education in Wind
Department of Aerospace Engineering Sciences
Department of Mechanical Engineering, by courtesy
University of Colorado at Boulder
Boulder, CO 80309-0429

Education

Ph.D. 1998 University of Stuttgart, Germany, Civil Engineering, thesis advisor: E. Ramm
B.S./M.S. 1992 University of Stuttgart, Germany, Aerospace Engineering

Employment

since 2010 *Associate Chair for Undergraduate Affairs*, Department of Aerospace Engineering Sciences, University of Colorado at Boulder
since 2008 *Director*, Center for Aerospace Structures, University of Colorado at Boulder
since 2006 *Associate Professor*, Department of Aerospace Engineering Sciences, University of Colorado at Boulder
2000-2006 *Assistant Professor*, Department of Aerospace Engineering Sciences, University of Colorado at Boulder
1998-1999 *Post-doctoral Research Associate*, Department of Aerospace Engineering Sciences, University of Colorado at Boulder
1992-1998 *Research Assistant*, Institute of Structural Mechanics, University of Stuttgart, Germany

Research Areas

- Design optimization of structural and coupled multi-physics problems
- Topology and shape optimization
- Reliability and stochastic analysis, design optimization under uncertainty
- Computational mechanics of structural and coupled multi-physics problems
- Parameter sensitivity analysis, Reduced order modeling
- Numerical methods for analysis and optimization of large-scale problems
- Design of smart structures and development of active materials
- Design of aerospace structures and micro-mechanical systems

Teaching Areas

- Engineering design
- Design optimization methods
- Structural Analysis
- Structural and computational mechanics

Selected Research Projects

1. *EFRI-SEED: Living Wall Materials and Systems for Automatic Building Thermo-Regulation*, NSF, Co-PIs: J. Zhai (PI), Y. Ding, J. Qi, F. Andreas, 2010 –2014.
2. *Modeling, Simulation and Design of Fluid-Matrix Composites*, CU Seed Grant, 2010.
3. *Tethered Coulomb Structure*, Co-Pi: H. Schaub (PI), 2009.
4. *Wind Turbine Drivetrain, Blade and Field Testing*, NREL, Co-PIs: S. Palo, 2008– 2010.
5. *A Design Tool for Nanostructures with Tunable Thermal Properties*, AFOSR, Co-PIs: R. Yang (PI), M.L. Dunn, 2008 – 2010.
6. *A Design-Centered Approach to Nano-Engineering*, NSF, Co-PIs: M.L. Dunn, R. Yang, 2007 – 2010.
7. *Immersive Digital Design and Teaching Environment for Fluid Dynamics*, CU-EEF, Co-PIs: G. Pinggen, 2007 – 2008.
8. *STTR - SMA flight control surfaces – Phase I & II*, ONR, 2005 – 2010.
9. *MURI: Energy Harvesting and Storage Systems for Air Force Aerovehicles*, AFOSR, Co-PIs: M.L. Dunn (PI), R. Yang, 2006 – 2010.
10. *STTR: Adaptive Skin-Stiffener Interconnects for Shape-Changing Vehicles – Phase I*, AFOSR, Co-PIs: J. Qi (PI), M.L. Dunn, 2006-2007.
11. *Design of Phononic Micro/ Nanostructures for Harsh Environment Device Technology*, AFOSR, Co-PIs: M.L. Dunn (PI), 2005 – 2007.
12. *Morphing at Large Stress and Strain through Electrochemical Actuation And Tailored Structural Design*, DARPA, Co-PIs: M.L. Dunn, R. Noble, C. Koval, 2004 – 2006.
13. *CAREER: A Biomimetic Approach to the Design of Shape-Controlled System*, NSF, 2004 – 2010.
14. *Adhesive Nanostructures*, NSF, Co-PIs: M.L. Dunn (PI), K. Stoldt, 2004 – 2005.
15. *Life-Cycle Reliability Analysis and Optimization of Microsystems*, NSF, Co-PIs: D. Frangopol, 2003 – 2006.
16. *Methodologies for Predicting and Testing the Effects of Combat Damage on Flight Envelopes*, AFOSR, Co-PIs: C. Farhat, P. Geuzaine, 2003-2005.
17. *Supersonic Aircraft Shaping Technology for a Constrained Shock Pressure Rise*, NASA, Co-PIs: C. Farhat (PI), B. Argrow, 2002 – 2003.
18. *Topology Optimization for the Design of 3-D Microelectromechanical Systems (MEMS) Undergoing Coupled Multiphysics Phenomena*, AFOSR, Co-PIs: M.L. Dunn (PI), V. Bright, 2002 – 2004.
19. *Novel SiCN Ceramics for Health Monitoring of High Temperature Systems*, AFOSR, Co-PIs: R. Raj (PI), D. Frangopol, 2001-2003.

Teaching and Mentoring

Undergraduate courses taught at CU Boulder since 2000:

Course Number	Title
ASEN2001	<i>Statics, Materials, and Structures</i>
ASEN3112	<i>Structures</i>
ASEN4338	<i>Computer Analysis of Structures</i>
ASEN4018	<i>Senior Design - Design Synthesis</i>
ASEN4028	<i>Senior Design - Design Practicum</i>
ASEN4519	<i>Structural Dynamics of Aerospace Systems</i>

Graduate courses taught at CU Boulder since 2000:

Course Number	Title
ASEN5012	<i>Mechanics of Aerospace Structures</i>
ASEN5022	<i>Dynamics of Aerospace Structures</i>
ASEN5519	<i>Design Optimization of Aerospace Structures</i>
ASEN5519	<i>Aeroelasticity</i>

Supervised post-doctoral research associates:

J. S. Kong, 2003 – 2005, J. Bai, 2003 – 2006, M. Liu, 2003 – 2005, A. Evgrafov, 2005–2008, P. Lee, 2008–2009.

Supervised Ph.D. thesis students (graduated):

M. Nikbay, 2000 – 2002, M. Raulli, 2001 – 2004, M. Allen, 2001 – 2004, J. Pajot, 2002–2006, R. Santos, 2003–2006, M. Barcelos, 2002–2007, G. Pingen, 2004–2008, G. Weickum, 2004–2008, C. Rupp, 2004–2009, M. Howard, 2005 – 2010.

Supervised Ph.D. thesis students (current):

S. Golman, since 2007, S. Kreissl, since 2008, D. Makhija, since 2008, C. DeLuca, since 2009, C. Lang, since 2009, J. Westfall, since 2010, N. Jenkins, since 2010.

Supervised M.S. thesis students (graduated and current):

J. Bollich, 2001 – 2002, R. Bischel, 2004 – 2005, R. Poola Subramanyaswamy, 2004 – 2005, K. Sylves, 2005-2007, N. Ledford, 2008 – 2010, V. Powell, 2009 – 2010.

Selected Honors and Awards

Year	Award
1998	Award for Excellence in Research at the University of Stuttgart, Germany
2004	NSF CAREER award
2004	AFRL Summer Faculty Fellowship
2005	Dean's Award for Outstanding Junior Faculty at the College of Engineering and Applied Sciences
2006	H. Joseph Smead Fellow
2007	Sandia Sabbatical Fellowship
2011	Research Fellowship from Kansai University, Japan

Publications

Names of Dr. Maute's graduate students are underlined; only refereed journal articles and book chapters are listed; conference proceedings and technical reports are omitted.

Refereed Journal Articles

- [1] S. Kreissl, G. Pingen, and K. Maute. An explicit level-set approach for generalized shape optimization of fluids with the lattice Boltzmann method. *International Journal for Numerical Methods in Fluids*, 65(5):496–519, 2011.
- [2] C.J. Rupp, M.L. Dunn, and K. Maute. Analysis of Piezoelectric Energy Harvesting Systems with Nonlinear Circuits Using the Harmonic Balance Method. *Journal of Intelligent Material Systems and Structures*, 21(14):1383-1396.
- [3] S. Kreissl, G. Pingen, A. Evgrafov, and K. Maute. Topology Optimization of Flexible Micro-Fluidic Devices. *Structural and Multidisciplinary Optimization*, 42(4):495-516, 2010.
- [4] G. Pingen and K. Maute. Optimal design for non-Newtonian flows using a topology optimization approach. *Computers and Mathematics with Applications*, 59(7):2340-2350, 2010.
- [5] X. Li, K. Maute, M.L. Dunn, and R. Yang. Strain Effects on the Thermal Conductivity of Nanostructures. *Physical Review B*, 81(24):245318, 2010.
- [6] S. Golmon, K. Maute, M.L. Dunn, S.-H. Lee. Stress Generation in Silicon Particles during Lithium Insertion. *Applied Physics Letters*, 97(3):033111, 2010.
- [7] C.J. Rupp, M.L. Dunn, and K. Maute. Switchable Phononic Wave Filtering, Guiding, Harvesting, and Actuating in Polarization-Patterned Piezoelectric Solids. *Applied Physics Letters*, 96(11):111902, 2010.
- [8] G. Pingen, M. Waidmann, A. Evgrafov, and K. Maute. A Parametric Level-Set Approach for Topology Optimization of Fluids. *Structural and Multidisciplinary Optimization*, 41(1): 117-131, 2010.
- [9] B. Argrow, K. Maute, C. Farhat, and M. Nikbay. F-function lobe balancing for sonic boom minimization. *Computational Fluid Dynamics Journal*, 17(4): 221-234, 2009.
- [10] C.J. Rupp, A. Evgrafov, K. Maute, and M.L. Dunn. Design of Piezoelectric Energy Harvesting Systems: A Topology Optimization Approach Based on Multilayer Plates and Shells. *Journal of Intelligent Material Systems and Structures*, 20(16):1923-1939, 2009.

- [11] M. Howard, J. Pajot, K. Maute, and M.L. Dunn. A Computational Design Methodology for Assembly and Actuation of Thin-Film Structures via Patterning of Eigenstrains. *Journal of Microelectromechanical Systems*, 18(5):1137-1148, 2009.
- [12] K. Maute, G. Weickum, and M. Eldred. A Reduced-Order Stochastic Finite Element Approach for Design Optimization under Uncertainty. *Structural Safety*, 31:450-459, 2009.
- [13] S. Golmon, K. Maute, and M.L. Dunn. Numerical Modeling of Electrochemical-Mechanical Interactions in Lithium Polymer Batteries. *Computers & Structures*, 87:1567-1579, 2009.
- [14] M.L. Dunn and K. Maute. Photomechanics of Liquid Crystal Elastomer Films. *Mechanics of Materials*, 41:1083-1089, 2009.
- [15] M. Raulli, and K. Maute. Reliability Based Design Optimization of MEMS Considering Pull-in. *ASME Journal of Mechanical Design*, 131(6):061014, 2009.
- [16] G. Weickum, M.S. Eldred, and K. Maute. A multi-point reduced-order modeling approach of transient structural dynamics with application to robust design optimization. *Structural and Multidisciplinary Optimization*, 38(6):599-611, 2009.
- [17] K. Sylves, K. Maute, and M.L. Dunn. Adhesive surface design using topology optimization. *Structural and Multidisciplinary Optimization*, 30(5):455-468, 2009.
- [18] A. Evgrafov, K. Maute, R. G. Yang, and M. L. Dunn. Topology optimization for nano-scale heat transfer. *International Journal for Numerical Methods in Engineering*, 77(3):285-300, 2009.
- [19] G. Pingen, A. Evgrafov, and K. Maute. Adjoint Parameter Sensitivity Analysis for the Hydrodynamic Lattice Boltzmann Method with Applications to Design Optimization. *Computers and Fluids* 38(4): 910-923, 2009.
- [20] A. Evgrafov, C.J. Rupp, K. Maute, and M.L. Dunn. Large-scale parallel topology optimization using a dual-primal substructuring solver. *Structural and Multidisciplinary Optimization*, 36(4):329-345, 2008.
- [21] A. Evgrafov, C.J. Rupp, M.L. Dunn, and K. Maute. Optimal Synthesis of Tunable Elastic Wave-Guides. *Computer Methods in Applied Mechanics and Engineering*, 198:292-301, 2008.
- [22] G. Pingen, A. Evgrafov, and K. Maute. A Parallel Schur Complement Solver for the Solution of the Adjoint Steady-State Lattice Boltzmann Equations: Application to Design Optimization. *International Journal of Computational Fluid Dynamics*, 22(7): 457 – 464, 2008.
- [23] K. Maute, C. Farhat, B. Argrow, and M. Nikbay. Sonic Boom Mitigation via Shape Optimization an adjoint method and application to a supersonic fighter aircraft. *European Journal of Computational Mechanics* 17: 217-243, 2008.
- [24] A. Evgrafov, G. Pingen, and K. Maute. Topology Optimization of Fluid Domains: Kinetic Theory Approach. *ZAMM* 88(2):129-41, 2008.
- [25] M. Barcelos and K. Maute. Aeroelastic Design Optimization for Viscous and Turbulent Flows. *Computer Methods in Applied Mechanics and Engineering*, 197(19-20):1813-1832, 2008.
- [26] C. Farhat, K. Maute, B. Argrow, and M. Nikbay. A Shape Optimization Methodology for Reducing the Sonic Boom Initial Pressure Rise. *AIAA Journal*, 45(5):1007-1018, 2007.
- [27] G. Pingen, A. Evgrafov, and K. Maute. Topology Optimization of Flow Domains using the Lattice Boltzmann Method. *Structural and Multidisciplinary Optimization*, 34(6):507-524, 2007.
- [28] J. Bai, K. Maute, S. Shah, and R. Raj. Mechanical Design for Accommodating Thermal Expansion Mismatch in Multilayer Coatings for Environmental Protection at Ultrahigh Temperatures. *J. Am. Ceram. Soc.*, 90(1): 170–176, 2007.
- [29] C.J. Rupp, A. Evgrafov, K. Maute, and M.L. Dunn. Design of Phononic Materials/Structures for Surface Wave Devices Using Topology Optimization. *Structural and Multidisciplinary Optimization*, 34(2):111-122, 2007.

- [30] M. Liu, D.M. Frangopol, and K. Maute. Multi-objective Design Optimization of Electrostatically Actuated Microbeam Resonators with and without Parameter Uncertainty. *Reliability Engineering and System Safety* 92:1333-1343, 2006.
- [31] J.M. Pajot and K. Maute. Analytical Sensitivity Analysis of Geometrically Nonlinear Structures Based on the Co-Rotational Finite Element Method. *Finite Elements in Analysis and Design*, 42: 900–913, 2006.
- [32] M. Barcelos, H. Bavestrello, and K. Maute. A Schur-Newton-Krylov Solver for Steady-state Aeroelastic Analysis and Design Sensitivity Analysis. *Computer Methods in Applied Mechanics and Engineering*, 195: 2050–2069, 2006.
- [33] K. Maute and G. Reich. An Integrated Multi-disciplinary Topology Optimization Approach for Adaptive Wing Design. *AIAA Journal of Aircraft*, 43(1):253 – 263, 2006.
- [34] J.M. Pajot, K. Maute, Y. Zhang, and M.L. Dunn. Design of Patterned Multilayer Films with Eigenstrains by Topology Optimization. *Journal for Solids and Structures*, 43(6): 1832-1853, 2006.
- [35] M. Raulli and K. Maute. Topology Optimization of Electrostatic Micro-electromechanical Systems. *Structural and Multidisciplinary Optimization*, 30(5): 342 – 359, 2005.
- [36] M. Allen and K. Maute. Reliability-based Shape Optimization of Structures undergoing Fluid Structure Interaction Phenomena. *Computer Methods in Applied Mechanics and Engineering*, 194:3472-3495, 2005.
- [37] M. Raulli and K. Maute. Optimization of Fully Coupled Electrostatic-Fluid-Structure Interaction Problems. *Computers & Structures*, 83:221-233, 2005.
- [38] C. Farhat, B. Argrow, M. Nikbay and K. Maute. Shape Optimization with F-Function Lobe Balancing for Reducing the Sonic Boom Initial Shock Pressure Rise. *International Journal of Aeroacoustics*, 3:361-378, 2004.
- [39] J.S. Kong, D.M. Frangopol, M. Raulli, K. Maute, R.A. Saravanan, L.-A. Liew and R. Raj. Variability in the performance of a novel ceramic MEMS actuator. *Sensors and Actuators A*, 116:336-344, 2004.
- [40] M. Allen and K. Maute. Reliability Based Optimization of Aeroelastic Structures. *Structural and Multidisciplinary Optimization*, 27:228-242, 2004.
- [41] M. Allen, M. Raulli, K. Maute and D.M. Frangopol. Reliability-Based Analysis and Design Optimization of Electrostatically Actuated MEMS. *Computers & Structures*, 82:1007-1020, 2004.
- [42] K. Maute and M. Allen. Conceptual Design of Aeroelastic Structures by Topology Optimization. *Structural and Multidisciplinary Optimization*, 27:27-42, 2004.
- [43] K. Maute and M. Raulli. An Adaptive Interactive Method for the Computer Aided Optimal Design of Engineering Systems. *Computers & Structures*, 82:71-79, 2004.
- [44] J.S. Kong, K. Maute, D.M. Frangopol, L.-A. Liew, R. A. Saravanan, and R. Raj. A Real-Time Human Machine Interface for an Ultrahigh Temperature MEMS Sensor-Igniter. *Sensors and Actuators A*, 105:23-30, 2003.
- [45] K. Maute and D.M. Frangopol. Reliability-based Design of MEMS Mechanisms by Topology Optimization. *Computers & Structures*, 81:813-824, 2003.
- [46] D.M. Frangopol and K. Maute. Life-cycle Reliability-based Optimization of Civil and Aerospace Structures. *Computers & Structures*, 81:397-410, 2003.
- [47] K. Maute, M. Nikbay and C. Farhat. Sensitivity Analysis and Design Optimization of Three-Dimensional Nonlinear Aeroelastic Systems by the Adjoint Method. *International Journal for Numerical Methods in Engineering*, 56:911-933, 2003.
- [48] K. Maute, M. Nikbay and C. Farhat. Coupled Analytical Sensitivity Analysis and Optimization of Three-dimensional Nonlinear Aeroelastic Systems. *AIAA Journal*, 39:2051-2061, 2001.

- [49] S. Schwarz, K. Maute, and E. Ramm. Topology and Shape Optimization for Elastoplastic Structural Response. *Computer Methods in Applied Mechanics and Engineering*, 190:2135-2155, 2001.
- [50] A. Schleupen, K. Maute, and E. Ramm. Adaptive FE-procedures in Shape Optimization. *Structural and Multidisciplinary Optimization*, 19:282-302, 2000.
- [51] K. Maute, S. Schwarz, and E. Ramm. Structural Optimization - The Interaction between Form and Mechanics. *ZAMM Journal for Applied Mathematics and Mechanics*, 79:651-674, 1999.
- [52] K. Maute, S. Schwarz, and E. Ramm. Adaptive Topology Optimization of Elastoplastic Structures. *Structural Optimization*, 15:81-91, 1998.
- [53] K. Maute and E. Ramm. Adaptive Topology Optimization of Shell Structures. *AIAA Journal*, 35:1767-1773, 1997.
- [54] K.-U. Bletzinger and K. Maute. Towards Generalized Shape and Topology Optimization. *Engineering Optimization*, 29:201-216, 1997.
- [55] K. Maute and E. Ramm. Adaptive topology Optimization. *Structural Optimization*, 10:100-112, 1995.

Book Chapters

- [56] K. Maute. Computational Optimization. Chapter in *Encyclopedia of Aerospace Engineering*, Wiley, 2011.
- [57] P. Lee, R. Yang, and K. Maute. An Extended Finite Element Method for the Analysis of Submicron Heat Transfer Phenomena. Chapter in *Multiscale Methods in Computational Mechanics*, Lecture Notes in Applied and Computational Mechanics, Springer, 2010.
- [58] K. Aifantis, K. Maute, M.L. Dunn, S. Hackney. Mechanics of Materials for Li-Battery Systems. Chapter 8 in *High Energy Density Lithium Batteries*, Weinheim: Wiley-Vch, 2010.
- [59] G. Weickum, M. Allen, K. Maute, and D.M. Frangopol. Design Optimization of Stochastic Dynamic Systems by Algebraic Reduced Order Models. Chapter 6 in *Structural Design Optimization considering Uncertainty*, Taylor and Francis, pages 135-154, 2008.
- [60] D.M. Frangopol, M. Liu and K. Maute. Design Optimization with Uncertainty, Life-Cycle Performance and Cost Considerations. Chapter 11 in *Optimization of Structural and Mechanical Systems*, World Scientific Publishing, pages 291-329, 2007.
- [61] D.M. Frangopol and K. Maute. Reliability-based Optimization of Civil and Aerospace Structural Systems. Chapter in *Engineering Design Reliability Handbook*, CRC Press, pages 24.1-24.32, 2005.
- [62] E. Ramm, K.-U. Bletzinger, and K. Maute. Strukturoptimierung - Das Wechselspiel zwischen Form und Kraft. Chapter in *Natürliche Konstruktionen in Raum und Zeit*, pages 93-125. IWB, Stuttgart, 2001.
- [63] K.-U. Bletzinger and K. Maute. Strukturoptimierung. Chapter in *Prozess und Form natürlicher Konstruktionen*, pages 131-147. Ernst & Sohn, Berlin, 1996.