

David Thomas Alfonso Fuentes

CONTACT INFORMATION The University of Texas MD Anderson Cancer Center
Department of Imaging Physics, Unit 56 *Work:* (713) 745-3377
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CITIZENSHIP USA

RESEARCH INTERESTS Image Guided Therapy, Optimization, Image Registration, Image Processing, Parallel Computing, Bioheat transfer, Real-Time Control, Error Estimation, Adaptivity, Fluid Mechanics, Solid Mechanics, Uncertainty Quantification

EDUCATION **The University of Texas at Austin**, Austin, Texas USA
Ph.D., Computational and Applied Mathematics, May 2008

- Thesis Topic: Computational Modeling and Real-Time Control of Patient-Specific Laser Treatment of Prostate Cancer
- Advisor: Professor J. Tinsley Oden
- Computational Engineering Science Option
- Overall GPA: 3.93/ 4.00

M.S., Computational and Applied Mathematics, August 2005

- Thesis Topic: Extensions of Goal-Oriented Error Estimation Methods to Simulations of Highly-Nonlinear Response of Shock-Loaded Elastomer-Reinforced Structures
- Advisor: Professor J. Tinsley Oden
- Co-Advisor: Professor David Littlefield
- Computational Engineering Science Option
- Overall GPA: 3.94/ 4.00

B.S., Aerospace Engineering, December 2002

- With Highest Honors
- Space Flight option
- Overall GPA: 3.94/ 4.00

PROFESSIONAL EXPERIENCE **The University of Texas MD Anderson Cancer Center**, Houston, Texas USA
Assistant Professor, Dept of Imaging Physics **June 2013 to present**
Instructor, Dept of Imaging Physics **September 2010 to May 2013**

- Develop computational software for image guided therapies
- Assist in proposal writing

The University of Texas MD Anderson Cancer Center, Houston, Texas USA
Postdoctoral Fellow **Fall 2008 to Fall 2010**

- Medical Physics Training Grant for Image-Guided Therapy Research
 - Courses: MR physics, PET physics, Nuc Med., Anatomy, Molecular Imaging
- Mentor: Assistant Professor R. Jason Stafford

The University of Texas at Austin, Austin, Texas USA

Graduate Research Assistant **January 2003 to Summer 2008**

- Develop finite element based software to study and explore new ideas in computational science
- Give lectures to clearly communicate new ideas to multi-disciplinary group of scientists
- Make presentations of computational results
- Maintain project website, dddas.ices.utexas.edu
- Assist in proposal writing
- Help with creation of annual reports

General Engineering Instructor Assistant **Spring/Fall Semester 2000**

- Assisted students in their pursuit to understand concepts of Engineering Physics (Mechanics/Electricity and Magnetism)
- Encouraged classroom participation
- Held regular office hours to help students individually
- Strengthened students' problem-solving skills

Undergraduate Student **June 1999 to December 2002**

Institute for Advanced Technology, Austin, Texas USA

Student Associate **Summer 2000 and January 2001 to December 2002**

- Conducted computer simulations of hyper velocity impacts and made weekly presentations of results
- Submitted institutional reports concerning results of simulations

AWARDS

- Recipient, J. T. Oden Faculty Fellow, June 2011, July 2013
- Recipient, NIH Medical Physics Training Grant 5T32CA119930-03, Fall 08 - Fall 10
- Recipient, CAM Fellowship, Fall 03 - Summer 07
- Finalist, USNCCM9 Student Presentation Competition
- University Honors, Fall 99 - Dec 02
- Recipient, Maureen M. and Richard E. Wakeland Endowed Scholarship in Engr. Fall 01 - Spring 02
- Recipient, ASE/EM Visiting Committee Scholarship Fall 00 - Spring 01

PUBLICATIONS

- [1] E. Castillo Jr., R. Castillo, **D. Fuentes**, and T. Guerrero. Computing Global Minimizers to a Constrained B-spline Image Registration Problem from Optimal l_1 Perturbations to Block Match Data. *Med. Phys.*, 2013. submitted.
- [2] C. MacLellan, **D. Fuentes**, J. Schwartz A. Elliott, J. Hazle, and R. J. Stafford. Estimating Nanoparticle Optical Properties with Magnetic Resonance Temperature Imaging and Bioheat Transfer Simulation. *Med. Phys.*, 2013. submitted.
- [3] E. Yeniaras, **D. Fuentes**, S. Fahrenholtz, J. Weinberg, F. Maier, J. Hazle, and R. J. Stafford. Novel Interventional Planning System for MR-guided Laser Ablation in Brain. *IJCars.*, 2013. submitted.
- [4] S. Fahrenholtz, R. J. Stafford, J. Hazle, and **D. Fuentes**. Generalised polynomial chaos-based uncertainty quantification for planning mrglitt procedures. *International Journal of Hyperthermia*, (0):1–12, 2013.

- [5] R. Castillo, E. Castillo, **D. Fuentes**, M. Ahmad, A. M Wood, M. S. Ludwig, and T. Guerrero. A Reference Dataset for Deformable Image Registration Spatial Accuracy Evaluation using the COPDgene Study Archive. *Physics in Medicine and Biology*, 58(9):2861, 2013.
- [6] **D. Fuentes**, A. Elliott, J. S. Weinberg, A. Shetty, J. D. Hazle, and R. J. Stafford. An Inverse Problem Approach to Recovery of In-Vivo Nanoparticle Concentrations from Thermal Image Monitoring of MR-Guided Laser Induced Thermal Therapy. *Ann. BME.*, 41(1):100–111, 2013.
- [7] Y. Feng and **D. Fuentes**. Model-Based Planning and Real-Time Predictive Control for Laser-Induced Thermal Therapy. *Inter. Journal Hyperthermia*, 27(8):751–761, 2011. invited review.
- [8] **D. Fuentes**, J. Yung, J. D. Hazle, J. S. Weinberg, and R. J. Stafford. Kalman Filtered MR Temperature Imaging for Laser Induced Thermal Therapies. *Trans. Medical Imaging*, 31(4):984–994, 2012. Special Issue on Interventional Imaging.
- [9] Y. Feng and **D. Fuentes**. Real-Time Predictive Surgical Control for Cancer Treatment Using Laser Ablation [Life Science]. *Signal Processing Magazine, IEEE*, 28(3):134–138, May 2011.
- [10] **D. Fuentes**, C. Walker, A. Elliott, A. Shetty, J. Hazle, and R. J. Stafford. MR Temperature Imaging Validation of a Bioheat Transfer Model for LITT. *International Journal of Hyperthermia*, 27(5):453–464, 2011. Cover Page.
- [11] R. J. Stafford, **D. Fuentes**, A. Elliott, and K. Ahrar. Laser Induced Thermal Therapy for Ablation. *Crit. Rev. Biomed. Eng.*, 38(1):79–100, 2010.
- [12] **D. Fuentes**, Y. Feng, A. Elliott, A. Shetty, R. J. McNichols, J. T. Oden, and R. J. Stafford. Adaptive Real-Time Bioheat Transfer Models for Computer Driven MR-guided Laser Induced Thermal Therapy. *IEEE Trans. Biomed. Eng.*, 57(5), 2010. Cover Page.
- [13] **D. Fuentes**, R. Cardan, R. J. Stafford, J. Yung, G. D. Dodd III, and Y. Feng. High Fidelity Computer Models for Prospective Treatment Planning of RF Ablation with *in vitro* Experimental Correlation. *J. of Vascular and Interventional Radiology*, 21(11):1725–1732, 2010.
- [14] **D. Fuentes**, J. T. Oden, K. R. Diller, J. Hazle, A. Elliott, , A. Shetty, and R. J. Stafford. Computational Modeling and Real-Time Control of Patient-Specific Laser Treatment Cancer. *Ann. BME.*, 37(4):763, 2009.
- [15] Y. Feng, **D. Fuentes**, A. Hawkins, J. Bass, and M. N. Rylander. Model-Based Optimization and Real-Time Control for Laser Treatment of Heterogeneous Soft Tissues. *CMAME*, 198(21-26):1742–1750, 2009. Advances in Simulation-Based Engineering Sciences Special Issue Honoring Prof. J. Tinsley Oden.
- [16] Y. Feng, **D. Fuentes**, A. Hawkins, J. Bass, M. N. Rylander, A. Elliott, A. Shetty, R. J. Stafford, and J. T. Oden. Nanoshell-Mediated Laser Surgery Simulation for Prostate Cancer Treatment. *Engineering with Computers*, 25(1):3–13, 2009.
- [17] J. T. Oden, **D. Fuentes**, J. Bass, and Y. Feng. Dynamic-Data-Driven Systems Aid Patient-Specific Cancer Therapy. *spie.org*, 2008.
- [18] K. R. Diller, J. T. Oden, C. Bajaj, J. C. Browne, J. Hazle, I. Babuška, J. Bass, L. Bidaut, L. Demkowicz, A. Elliott, Y. Feng, **D. Fuentes**, S. Goswami, A. Hawkins, S. Khoshnevis, B. Kwon, S. Prudhomme, and R. J. Stafford. *Advances*

in Numerical Heat Transfer, volume 3: Numerical Implementation of Bioheat Models and Equations, chapter 9: Computational Infrastructure for the Real-Time Patient-Specific Treatment of Cancer. Taylor & Francis Group, 2008.

- [19] J. T. Oden, K. R. Diller, C. Bajaj, J. C. Browne, J. Hazle, I. Babuška, J. Bass, L. Demkowicz, Y. Feng, **D. Fuentes**, S. Prudhomme, M. N. Rylander, R. J. Stafford, and Y. Zhang. Dynamic Data-Driven Finite Element Models for Laser Treatment of prostate cancer. *Num. Meth. PDE*, 23(4):904–922, 2007.
- [20] **D. Fuentes**, D. Littlefield, J.T. Oden, and S. Prudhomme. Extensions of goal-oriented error estimation methods to simulations of highly-nonlinear response of shock-loaded elastomer-reinforced structures. *Comput. Methods Appl. Mech. Engrg.*, 195:4659–4680, 2006.

CONFERENCE
PROCEEDINGS

- [1] E. Yeniaras, **D. Fuentes**, S. Fahrenholtz, R. He, J. Hazle, and R. J. Stafford. 3D Slicer Based Approach for Planning and Performing Image Guided Laser Induced Thermal Therapy. In *5th Image Guided Therapy Workshop, NCIGT, Department of Radiology, Brigham and Women's Hospital, and Harvard Medical School, Boston, MA, USA.*, volume 5, page 20, 2012.
- [2] J. Yung, **D. Fuentes**, J. Hazle, and R. Stafford. A Phantom Validation Study of a 3D Background Phase Model for MR Thermometry. *Medical physics*, 39(6):3664, 2012.
- [3] S. Fahrenholtz, **D. Fuentes**, R. Stafford, and J. Hazle. Uncertainty Quantification by Generalized Polynomial Chaos for MR-Guided Laser Induced Thermal Therapy. *Medical physics*, 39(6):3857, 2012.
- [4] Y. Feng, **D. Fuentes**, R. J. Stafford, and J. T. Oden. Model-Based Real-Time Control for Laser Induced Thermal Therapy with Applications to Prostate Cancer Treatment. volume 7175, page 717515. SPIE, 2009.
- [5] Y. Feng, **D. Fuentes**, A. Hawkins, and J. T. Oden. MRTI-Based Optimization and Real-Time Laser Surgical Control for Cancer Treatment Using Fast Inverse Analysis Techniques. In *BioMedical Engineering and Informatics, 2008. BMEI 2008.*, volume 2, pages 168–172, May 2008.
- [6] C. Bajaj, J. T. Oden, K. R. Diller, J. C. Browne, J. Hazle, I. Babuska, J. Bass, L. Bidaut, L. Demkowicz, A. Elliott, Y. Feng, **D. Fuentes**, S. Prudhomme, R. J. Stafford, and Y. Zhang. Using Cyber-Infrastructure for Dynamic Data Driven Laser Treatment of Cancer. In *Proceedings Lecture Notes in Computer Science*, volume 4487, pages 972–979, 2007.
- [7] J. T. Oden, K. R. Diller, C. Bajaj, J. C. Browne, J. Hazle, I. Babuska, J. Bass, L. Demkowicz, A. Elliott, Y. Feng, **D. Fuentes**, S. Prudhomme, M. N. Rylander, R. J. Stafford, and Y. Zhang. Development of a Computational Paradigm for Laser Treatment of Cancer. In *Proceedings Lecture Notes in Computer Science*, volume 3993, pages 530–537, 2006.

PRESENTATIONS

- [1] **D. Fuentes**. The Impact of Uncertainty in Nonlinear Temperature Dependent Constitutive Parameters on Predictive Computer Modeling of MRgLITT Procedures, May 2013. ISMRM, Salt Lake City, Utah, E-Poster Presentation.
- [2] **D. Fuentes**. Fast Steady State Solution for Simulating Bioheat Distribution for Image Guided Laser Ablation, April 2013. STM 2013 Annual Meeting. Aruba. .

- [3] **D. Fuentes.** Planning of MR-Guided Laser Induced Thermal Therapy Using UQ Methods, February 2013. SIAM Computational Science and Engineering. Boston, Massachusetts.
- [4] **D. Fuentes.** Computer Model Assisted Treatment Planning and Data Assimilation for MRgLITT, November 2012. CAAM Colloquium. Rice University. Houston, Texas.
- [5] **D. Fuentes.** UQ Based Planning of MR Guided Laser Induced Thermal Therapy in Brain, May 2012. SAMSI. UQ Transition Workshop. Research Triangle Park, North Carolina.
- [6] **D. Fuentes.** Kalman Filtered Temperature Imaging for Monitoring MRgLITT procedures, April 2012. STM 2012 Annual Meeting. Portland, Oregon.
- [7] **D. Fuentes.** Computer Model Assisted Planning and Monitoring for MRgLITT, November 2011. Memphis BioImaging Symposium. Memphis, Tennessee.
- [8] **D. Fuentes.** Prospective Planning of MR guided Laser Induced Thermal Therapy in Brain, July 2011. National Congress on Computational Mechanics. Minneapolis, Minnesota. Conference Presentation.
- [9] **D. Fuentes.** Kalman Filtered MR Temperature Imaging, May 2011. ISMRM 2011 Annual Meeting. Track: MR Guided Focused Ultrasound, ThermoTherapy & Thermometry, Montreal, Canada. E-Poster Presentation.
- [10] **D. Fuentes.** High Fidelity Computer Models for Prospective Treatment Planning of Radiofrequency Ablation, April 2011. STM 2011 Annual Meeting. New Orleans, Louisiana. Poster Presentation.
- [11] R. J. Stafford and **D. Fuentes.** Computational Tools for MR Guided Laser Induced Thermal Therapies, April 2011. Shell Bellaire Technology Center, Houston, Texas, Invited Presentation.
- [12] **D. Fuentes.** Real-Time Model Assisted MR Temperature Imaging for Monitoring LITT Procedures, October 2010. BMES 2010 Annual Meeting. Track: Biomedical Imaging and Optics, Austin, Texas, Oral Presentation.
- [13] **D. Fuentes.** MR Temperature Imaging Validation of a Bioheat Transfer Model for 3D Prospective Planning of LITT, September 2010. Eighth Interventional MRI Symposium. Leipzig, Germany, Poster Presentation.
- [14] **D. Fuentes.** Real-Time Bioheat Transfer Models for Computer Driven MR guided LITT, May 2010. ISMRM, Stockholm, Sweden, E-Poster Presentation.
- [15] **D. Fuentes.** Development and Integration of High-Performance Computation and Simulation in MR-Guided Thermal Therapy, April 2010. Research Imaging Seminar, MDACC, Houston, TX.
- [16] **D. Fuentes.** Thermal Image Reconstruction of *In Vivo* Nanoparticle Concentrations for MR-Guided Laser Induced Thermal Therapy Optimization, February 2010. NanoEngineering for Medicine and Biology, Houston, Texas, Conference Presentation.
- [17] **D. Fuentes.** Computational and MR-guided Patient Specific Thermal Therapy of Cancer, October 2009. Southwest Chapter of the AAPM Fall Meeting. Houston, Texas, Conference Presentation.

- [18] **D. Fuentes.** Image-Based Biomedical Simulation and Parallel Computing, April 2009. The University of Texas at San Antonio. Invited Lecture. Joint graduate class of Advanced Finite Element Methods and College of Engineering ME Seminar Series.
- [19] J. T. Oden and **D. Fuentes.** Computational Modeling and Real-Time Control of Patient-Specific Laser Treatment of Cancer, September 2008. Seventh Interventional MRI Symposium. Baltimore, Maryland, Conference Presentation.
- [20] **D. Fuentes.** Remote Laser Cancer Surgery: A Minimally Invasive Alternative to the Standard Treatment, July 2008. The Austin Forum. Austin, Texas, Invited Presentation.
- [21] **D. Fuentes.** A Data Driven Application System for Laser Treatment of Cancer, July 2007. National Congress on Computational Mechanics. San Francisco, California, Conference Presentation.
- [22] **D. Fuentes.** Development of a Computational Paradigm for Laser Treatment of cancer, July 2006. World Congress on Computational Mechanics. Los Angeles, California, Conference Presentation.
- [23] **D. Fuentes.** An Application of Goal-oriented Error Estimation to Shock Loaded Elastomeric Materials, July 2005. National Congress on Computational Mechanics. Austin, Texas, Conference Presentation.

OTHER
MANUSCRIPTS

- [1] E. Castillo Jr., R. Castillo, X. Gu, J. Martinez, **D. Fuentes**, S. Jiang, P. Friedman, and T. Guerrero. Deformable Image Registration for Breath-hold CT Image Pairs from the COPDgene Study. 2011.
- [2] **D. Fuentes**, J. T. Oden, K. R. Diller, A. Elliott, Y. Feng, J. D. Hazle, A. Shetty, , and R. J. Stafford. *Dynamic Data Driven Application Systems*, chapter Computational and MR-guided Patient-Specific Laser Induced Thermal Therapy of Cancer. 2009.

COURSES TAUGHT

- The University of Texas Graduate School of Biomedical Sciences (GSBS)
- GS02-1183 Applied Mathematics for Medical Physics Fall, 2012

COMMITTEE
PARTICIPATION

- Student Examination Committee
- Samuel Fahrenholtz, GSBS Med Phys Program, (Advisor Jason Stafford)
 - Funding: NIH T32, UT Health Science Center, Center for Clinical and Translational Sciences, 2013-
 - Christopher MacLellan, GSBS Med Phys Program, (Advisor Jason Stafford)
 - Funding: NIH T32, UT Health Science Center, Center for Clinical and Translational Sciences, 2013-

Institutional Service

- IREC Research IT Subcommittee, Summer 2012
- DI Informatics Functional Committee, Aug 2013-

RESEARCH
SUPPORT

- [1] CABIR-GE In-Kind Research Award. MRI for Minimally Invasive Therapy. The University of Texas MD Anderson Cancer Center, 2013-2014. Total Cost: \$150K
PI: R. J. Stafford, Role: Co-Investigator.

- [2] National Science Foundation 12-571. A Portable Treatment Planning System for MR-Guided Thermal Therapy. The University of Texas MD Anderson Cancer Center, 5/13-12/14. Total Cost: \$150K, PI: **D. Fuentes**.
- [3] National Institutes of Health 12-149. Admin Supplement, Spatially Accurate Deformable Image Registration for Thoracic CT Application DP2OD007044. The University of Texas MD Anderson Cancer Center, 3/13-2/15. Direct Cost: \$2M, PI: T. Guerrero, Role: Collaborator.
- [4] Department of Defense Hyp. Development Award. Photoacoustic and Ultrasound Needle Guided Biopsy. The University of Texas MD Anderson Cancer Center, 3/13-2/14. Direct Cost: \$75K, PI: R. Bouchard, Role: Co-Investigator.

- PENDING SUPPORT
- [1] National Institutes of Health 13-169. Academic-Industrial Partnerships for Translation of in vivo Imaging Systems for Cancer Investigations. The University of Texas MD Anderson Cancer Center, 1/14-4/18. Direct Cost: \$2M, PI: J. Stafford, Role: Co-Investigator.
 - [2] National Institutes of Health 13-185. PET Guided PTA-Chemotherapy of Unresectable Liver Tumors. The University of Texas MD Anderson Cancer Center, 1/14-12/17. Direct Cost: \$3M, PI: C. Li, Role: Collaborator.

- PAST RESEARCH SUPPORT
- [1] National Institutes of Health: 1R21EB010196-01A1. Prospective 3D Treatment Planning for MR-Guided Laser Induced Thermal Therapy Procedures. The University of Texas MD Anderson Cancer Center, 2010-2012. Direct Cost: \$275K PI: R. J. Stafford, Role: Co-Investigator.
 - [2] National Institutes of Health: 5T32CA119930-05. Medical Physics Training Grant for Image-Guided Therapy Research. The University of Texas MD Anderson Cancer Center, 2008-2010. PI: E. Jackson, Role: Postdoctoral Fellow.

REFEREE ACTIVITIES

- Journals:
- International Journal Hyperthermia
 - IEEE Transactions Medical Imaging
 - IEEE Transactions Biomedical Engineering
 - Medical Physics
 - Computer Methods in Applied Mechanics and Engineering

PROFESSIONAL MEMBERSHIPS & AFFILIATIONS

- International Society for Magnetic Resonance in Medicine
- Medical Physics Program Faculty
- The University of Texas Graduate School of Biomedical Sciences Associate Faculty Member

TECHNICAL SKILLS Extensive software experience in computational science working with a variety of languages and with a multitude of commercial/open source packages

Exceptional scientific visualization skills

Strong engineering problem-solving skills

Good communication, presentation, and writing skills

Very good working in a team environment

Experience working with PETSc, MPI, CUDA, TAO, ITK, CImg, STL, Amira, Cubit, Paraview, OpenMP, 3DSlicer

Programming: C, C++, Python, Fortran, Matlab, SVN, Git

Applications: L^AT_EX, B_IB_TE_X, Gimp, Xfig, Microsoft Office, and other common productivity packages for Windows, and Linux platforms

Operating Systems: Microsoft Windows 7/XP, Linux, and other UNIX variants