

Mansoor A. Haider

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A. EDUCATION

Ph.D. (1996) Mathematical Sciences, Rensselaer Polytechnic Institute (RPI), Troy, NY
B.Math (1991) Applied Mathematics & Computer Science, University of Waterloo, Canada (co-op degree, included 24 months of internships)

B. EMPLOYMENT (post-PhD)

2011-Present *Professor*, Department of Mathematics, NCSU
2022-Present *Director*, Foundations of Data Science MS Program, NCSU
2018-2021 *Associate Director*, Statistical & Applied Mathematical Sciences Institute (SAMSI), Research Triangle Park, NC
2012-2016 *Director of Graduate Programs*, Department of Mathematics, NCSU (Mathematics & Applied Mathematics MS & PhD programs)
2005-2011 *Associate Professor*, Department of Mathematics, NCSU
1999-2005 *Assistant Professor*, Department of Mathematics, NCSU
1997-1999 *Instructor/NSF Post-Doc*, Department of Mathematics, Duke University
Postdoctoral Associate, Center for Mathematics and Computation in the Life Sciences and Medicine, Duke University
1996-1997 *Visiting Assistant Professor*, Department of Mathematics, Duke University
Current Affiliations *Associate Faculty*, Biomathematics Graduate Program, NCSU
Associate Faculty, Center for Research in Scientific Computation, NCSU
Associate Faculty, Dept. of Biomedical Engineering, NCSU

C. RESEARCH AREAS

- Applied mathematics: PDEs, continuum mechanics, boundary integral equations, perturbation methods, multiscale modeling, data-driven modeling, parameter identifiability, model reduction
- Bio-mathematical modeling: biomechanics and mechanobiology of soft tissues, elasticity, viscoelasticity, poroelasticity, continuum mixture theories, contact problems, cell-matrix interactions, articular cartilage, osteoarthritis, tissue engineering, tissue development, wound healing, ultrasonic imaging, OCT imaging
- Scientific computing: boundary element methods, finite element methods, artificial neural networks, machine learning, data clustering algorithms

D. HONORS, AWARDS & APPOINTMENTS

- Member, SIAM Committee on Science Policy (2021-2026)
- Editorial Board, Journal of Biomechanics (2007-Present)
- Larry Norris Faculty Award (for service), NCSU Mathematics Dept (2022)
- NCSU Gertrude M. Cox Award for Excellence in Teaching & Learning with Technology (2013)
- NCSU Academy of Outstanding Teachers (2005-Present)
- NCSU Outstanding Teacher Award (2004-05)

- ASME Richard Skalak Award for best paper in Journal of Biomechanical Engineering (2004)
- NSF Mathematical Sciences Postdoctoral Research Fellowship (1997-2000)
- NSF Graduate Research Fellowship (1993-1996)
- Huston Prize – Teaching award in Mathematical Sciences Department, R.P.I. (1993)

E. FUNDING

Active

Sandia National Labs LDRD program, \$190,000, 11/1/22 to 9/30/24

“Spatiotemporal Dual-Domain Clustering of Epidemiological Data,” Role: PI

NSF-DMS-Computational & Data-enabled Science & Engineering, \$70,000, 8/1/21-7/31/23

“Collaborative Research: Surrogates and Reduced Order Modeling for High Dimensional Coupled Systems,” Role: Co-PI, PI: R. Smith (NCSU), DMS-2053812

NCSU Research & Innovation Seed Funding, \$25,000, 2/1/23-1/31/24

“Modeling Mechanisms for Ultrasound Stimulation of Platelet-like Particles,” Role: Co-PI, M Muller (PI) A Brown (Co-PI)

Previously Held

NSF-DMS-Math Biology, \$430,000, 8/1/16-7/31/21

“Remodeling of Pulmonary Cardiovascular Networks in the Presence of Hypertension,”

Role: Co-PI, PI: M Olufsen (NCSU), Co-PI: MU Qureshi (NCSU), DMS-1615820

NSF-DMS-Math Sciences Research Institutes, \$9,291,999, 9/1/17 to 8/31/22 [main award]

“Statistical and Applied Mathematical Sciences Institute,”

Role: Co-PI, PI: D Banks (Duke), Co-PIs: MG Forest (UNC), M Clyde (Duke), E Ceyhan (NCSU), DMS-1638521

NSF-DMS-Math Sciences Research Institutes, \$1,800,000, 8/1/20 to 8/31/22 [sundown award]

“Statistical and Applied Mathematical Sciences Institute,”

Role: Co-PI, PI: D Banks (Duke), Co-PIs: MG Forest (UNC), R Kuske (Ga Tech), DMS-1929298

Distance Education and Learning Technology Applications (DELTA), \$119,000, 7/1/16-6/30/17

“Postbaccalaureate Graduate Certificate in Mathematics: Initiating an Online Track,”

Role: Co-PI, PI: PA Gremaud (NCSU)

NCSU Research Innovation Seed Funding (RISF), \$33,876, 1/1/16 to 12/31/16

“Discovery and modeling of clonality in forebrain stem cells during gliogenesis,”

Role: Co-PI, PI: HT Ghashghaei (NCSU), Co-PI: J Meitzen (NCSU)

NSF-DMS-Math Biology, \$343,687, 10/1/11-9/30/16

“Arterial wall viscoelasticity and cardiovascular networks,”

Role: Co-PI, PI: M Olufsen (NCSU), DMS-1122424

Distance Education and Learning Technology Applications (DELTA), \$63,272, 8/15/11-6/30/13

“Large Course Redesign (LCR) of Applied Differential Equations I (MA341),”

Role: Co-PI, PI: A Duca (NCSU)

NSF – DMS – EMSW21 – Research Training Groups, \$1,537,646, 7/1/07-6/30/13

“EMSW21-RTG Mathematics of materials: model development, analysis, simulation and control”

Role: Co-PI, PI: R Smith (NCSU), Co-PIs: P Gremaud (NCSU), N Medhin (NCSU), M Shearer (NCSU) DMS-0636590

North Carolina Biotechnology Ctr (via subcontract), \$39,319, 8/1/10-6/30/12
“Optimizing in situ cross-linking of hyaluronic acid for cartilage tissue engineering”
Role: NCSU PI, PI: S Craig (Duke), Co-PI: LA Setton (Duke)

NIH – NIA (via subcontract), \$254,752, 4/1/08-3/31/12
“Viscoelastic properties of normal and OA chondrons”
Role: NCSU PI, PI: F Guilak (Duke), 2R01AG015768-11

NIH – NIBIB (via subcontract), \$100,074, 9/29/03-7/31/07
“Genetically designed materials for cartilage repair,”
Role: NCSU PI, PI: LA Setton (Duke), Co-PI: A Chilkoti (Duke), NIH-1R01EB002263-01

The Whitaker Foundation, \$238,675, 9/1/03-12/31/06
“Multiphasic mechanics of the chondron: effects of the physicochemical environment”
Role: Sole PI, RG-02-0933 (funding rate: 44 out of 334 invited proposals)

NSF – DMS – Applied Mathematics, \$94,700, 9/1/02-8/31/05
“Modeling mechanical cell-matrix interactions in articular cartilage”
Role: Sole PI, DMS-0211154

DARPA/ONR, \$97,941, 6/1/02-2/28/03
“Time-reversal for electromagnetic waves in complex media”
Role: Co-PI, PI: JP Fouque (NCSU), N00014-02-1-0739

NSF- Mathematical Sciences Postdoctoral Research Fellowship, \$75,000, 7/1/97-5/31/00
“Modeling deformation in a biological soft tissue”
Role: Sole PI, DMS-9705931

F. PUBLICATIONS

Google Scholar: Citations = 2385, h-index = 25, i10-index = 33 (as of 1/4/2024)

Peer-reviewed journals & book chapters

F68. (to appear) MA Haider, KJ Pearce, NC Chesler, NA Hill and MS Olufsen, Application and reduction of a nonlinear hyperelastic wall model capturing ex vivo relationships between fluid pressure, area and wall thickness in normal and hypertensive murine left pulmonary arteries, *International Journal for Numerical Methods in Biomedical Engineering*

F67. (in revision) KJ Pearce, ICF Ipsen, MA Haider, AK Saibaba and RC Smith, Robust parameter identifiability analysis via column subset selection, submitted, <https://arxiv.org/abs/2205.0420>, 22 pages

F66. (2024) K Dadashova, RC Smith and MA Haider, Local identifiability analysis, parameter subset selection and verification for a minimal brain PBPK model, *Bulletin of Mathematical Biology*, <https://doi.org/10.1007/s11538-023-01234-4>

F65. (2023) X Zhang, G Xiao, C Johnson, Y Cai, ZK Horowitz, C Mennicke, R Coffey, MA Haider, D Threadgill, R Eliscu, MC Oldham, A Greenbaum, HT Ghashghaei, Bulk and mosaic deletions of *Egfr* reveal regionally defined gliogenesis in the developing mouse forebrain, *iScience*, Vol. 26, No. 3, 106242, <https://doi.org/10.1016/j.isci.2023.106242>

F64. (2022) ME McMahan, L Doroshenko, J Roostaei, H Cho and MA Haider, Unsupervised learning methods for efficient geographic clustering and identification of disease disparities with applications to county-level colorectal cancer incidence in California, submitted to *Health Care Management Science*, 19 pages, <https://doi.org/10.1007/s10729-022-09604-5>, published online 6/23/22.

F63. (2021) KJ Pearce, K Nellenbach, RC Smith, AC Brown and MA Haider, Modeling and parameter subset selection for fibrin polymerization kinetics with applications to wound healing, submitted to *Bulletin of Mathematical Biology*, Vol. 83, 47 (22 pages), <https://doi.org/10.1007/s11538-021-00876-6>

- F62.** (2020) X Zhang, CV Mennicke, G Xiao, R Beattie, MA Haider, S Hippenmeyer and H. Ghashghaei, Clonal analysis of gliogenesis in the cerebral cortex reveals stochastic expansion of glia and cell autonomous responses to Egfr dosage, *Cells*, Vol. 9, 2662, <https://doi.org/10.3390/cells9122662>
- F61.** (2019) S.D. Olson and M.A. Haider, A computational reaction–diffusion model for biosynthesis and linking of cartilage extracellular matrix in cell-seeded scaffolds with varying porosity, *Biomechanics and Modeling in Mechanobiology*, Vol. 18, pp. 701-716 <https://doi.org/10.1007/s10237-018-01110-4>
- F60.** (2018) M.U. Qureshi, M.J. Colebank, L.M. Paun, L. Ellwein-Fix, N. Chesler, M.A. Haider, N.A. Hill, D. Husmeier and M.S. Olufsen, Hemodynamic assessment of pulmonary hypertension in mice: A model based analysis of the disease mechanism, *Biomechanics and Modeling in Mechanobiology*, Vol. 18, pp. 219-243, <https://doi.org/10.1007/s10237-018-1078-8>.
- F59.** (2018) L.M. Paun, M.U. Qureshi, M. Colebank, N.A. Hill, M.S. Olufsen, M.A. Haider and D. Husmeier, MCMC methods for inference in a mathematical model of pulmonary circulation, *Statistica Neerlandica*, Vol. 72, pp. 306-338, <https://doi.org/10.1111/stan.12132>.
- F58.** (2018) M.U. Qureshi, M.J. Colebank, D.A. Schreier, D.M. Tabima, M.A. Haider, N.C. Chesler and M.S. Olufsen, Characteristic impedance: Frequency or time domain approach?, *Physiological Measurement*, Vol. 39, #014004, <https://doi.org/10.1088/1361-6579/aa9d60>
- F57.** (2016) C. Battista, D. Bia, Y. Zocalo, R.L. Armentano, M.A. Haider and M.S. Olufsen, Wave propagation in a 1D fluid dynamics model using pressure-area measurements from ovine arteries, *Journal of Mechanics in Medicine and Biology*, Vol. 16, DOI: 10.1142/S021951941650007X.
- F56.** (2014) A. Aristotelous and M.A. Haider, Evaluation of diffusive transport and cellular uptake of nutrients in tissue engineered constructs using a hybrid discrete mathematical model, *Processes*, Vol. 2, pp. 333-344
- F55.** (2014) A. Aristotelous and M.A. Haider, Use of hybrid discrete cellular models for identification of macroscopic nutrient loss in reaction-diffusion models of tissues, *International Journal for Numerical Methods in Biomedical Engineering*, Vol. 20, pp. 767-780
- F54.** (2011) Z. Hu and M.A. Haider, Algebraic multigrid preconditioning for finite element solution of inhomogeneous elastic inclusion problems in articular cartilage, *Advances in Applied Mathematics and Mechanics*, Vol. 3, pp. 729-744
- F53.** (2011) B.N. Steele, D. Valdez-Jasso, M.A. Haider and M.S. Olufsen, Predicting arterial flow and pressure dynamics using a 1D fluid dynamics model with a viscoelastic wall, *SIAM Journal on Applied Mathematics*, Vol. 71, pp. 1123-1143
- F52.** (2011) M.A. Haider, J.E. Olander, R.F. Arnold, D.R. Marous, A.J. McLamb, K.C. Thompson, W.R. Woodruff and J.M. Haugh, A phenomenological mixture model for biosynthesis and linking of cartilage extracellular matrix in scaffolds seeded with chondrocytes, *Biomechanics and Modeling in Mechanobiology*, Vol. 10, pp. 915-924
- F51.** (2011) D. Valdez-Jasso, D. Bia, Y. Zocalo, R.L. Armentano, M.A. Haider and M.S. Olufsen, Linear and nonlinear viscoelastic modeling of aorta and carotid pressure-area dynamics under in vivo and ex vivo conditions, *Annals of Biomedical Engineering*, Vol. 39, pp. 1438-1456
- F50.** (2010) M. Stuebner and M.A. Haider, A fast quadrature-based numerical method for the continuous spectrum biphasic poroviscoelastic model of articular cartilage, *Journal of Biomechanics*, Vol. 43, pp. 1835-1839
- F49.** (2010) E. Kim, F. Guilak and M.A. Haider, An axisymmetric boundary element model for determination of articular cartilage pericellular matrix properties in situ via inverse analysis of chondron deformation, *Journal of Biomechanical Engineering*, Vol. 132:031011, 13 pages
- F48.** (2010) M.A. Haider, B.A. Benedict, E. Kim and F. Guilak, Computational modeling of cell mechanics in articular cartilage, in *Computational Modeling in Biomechanics* (eds. S. De, F. Guilak and M.R.K. Mofrad), Springer, New York, pp. 329-352

- F47.** (2010) D.L. Nettles, M.A. Haider, A. Chilkoti and L.A. Setton, Neural network analysis identifies scaffold properties necessary for in vitro chondrogenesis in elastin-like polypeptide biopolymer scaffolds, *Tissue Engineering Part A*, Vol. 16, pp. 11-20
- F46.** (2009) D. Valdez-Jasso, M.A. Haider, H.T. Banks, D.B. Santana, Y.Z. German, R. Armentano and M.S. Olufsen, Analysis of viscoelastic wall properties in ovine arteries, *IEEE Transactions on Biomedical Engineering*, Vol. 56, pp. 210-219
- F45.** (2009) S.D. Olson and M.A. Haider, A level set reaction-diffusion model for tissue regeneration in articular cartilage, *International Journal of Pure and Applied Mathematics*, Vol. 53, pp. 333-353
- F44.** (2009) D. Valdez-Jasso, H.T. Banks, M.A. Haider, D. Bia, Y. Zocalo, R.L. Armentano and M.S. Olufsen, Viscoelastic models for passive arterial wall dynamics, *Advances in Applied Mathematics and Mechanics*, Vol. 1, pp. 151-165
- F43.** (2008) E. Kim, F. Guilak and M.A. Haider, The dynamic mechanical environment of the chondrocyte: A biphasic finite element model of cell-matrix interactions under cyclic compressive loading, *Journal of Biomechanical Engineering*, Vol. 130:061009, 10 pages
- F42.** (2008) F.W. Mauldin, M.A. Haider, E.G. Loba, R.H. Behler, L.E. Euliss, T.W. Pfeiler and C.M. Gallippi, Monitored steady-state excitation and recovery (MSSER) radiation force imaging using viscoelastic models, *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Controls*, Vol. 55, pp. 1597-1610
- F41.** (2007) M.A. Haider and F. Guilak, Application of a three-dimensional poroelastic BEM to modeling the biphasic mechanics of cell-matrix interactions in articular cartilage, *Computer Methods in Applied Mechanics and Engineering*, Vol. 196, pp. 2999-3010
- F40.** (2006) M.A. Haider, R.C. Schugart, L.A. Setton and F. Guilak, A mechano-chemical model for the passive swelling response of an isolated chondron under osmotic loading, *Biomechanics and Modeling in Mechanobiology*, Vol. 5, pp. 160-171
- F39.** (2006) M.A. Haider and R.C. Schugart, A numerical method for the continuous spectrum biphasic poroviscoelastic model of articular cartilage, *Journal of Biomechanics*, Vol. 39, No. 1, pp. 177-183
- F38.** (2006) H.A. Leddy, M.A. Haider and F. Guilak, Diffusional anisotropy in collagenous tissues: fluorescence imaging of continuous point photobleaching, *Biophysical Journal*, Vol. 91, pp. 311-316
- F37.** (2006) F. Guilak, L.G. Alexopoulos, M.L. Upton, I. Youn, J.B. Choi, L.A. Setton and M.A. Haider, The pericellular matrix as a transducer of biomechanical and biochemical signals in cartilage, *Annals of the New York Academy of Sciences*, 1068:498-512
- F36.** (2006) F. Guilak, M.A. Haider, F.P.T. Baaijens, T.A. Laursen and L.A. Setton, Multiphasic models of cell mechanics, in *Cytoskeletal Mechanics: Models and Measurements* (eds. M. Kaazempur-Mofrad and R. Kamm), pp. 84-102, Cambridge University Press, New York
- F35.** (2005) F. Guilak, L.G. Alexopoulos, M.A. Haider, H.P. Ting-Beall and L.A. Setton, Zonal uniformity in mechanical properties of the chondrocyte pericellular matrix: micropipette aspiration of canine chondrons isolated by cartilage homogenization, *Annals of Biomedical Engineering*, Vol. 33, pp. 1312-1318
- F34.** (2004) M.A. Haider, A radial biphasic model for local cell-matrix mechanics in articular cartilage, *SIAM Journal on Applied Mathematics*, Vol. 64, pp. 1588-1608
- F33.** (2004) M.A. Haider, K.J. Mehta and J.P. Fouque, Time-reversal simulations for detection in randomly layered media, *Waves in Random Media*, Vol. 14, pp. 185-198
- F32.** (2003) L.G. Alexopoulos, M.A. Haider, T.P. Vail and F. Guilak, Alterations in the mechanical properties of the human chondrocyte pericellular matrix with osteoarthritis, *Journal of Biomechanical Engineering*, Vol. 125, pp. 323-333
- F31.** (2002) M.A. Haider and F. Guilak, An axisymmetric boundary integral model for assessing elastic cell properties in the micropipette aspiration contact problem, *Journal of Biomechanical Engineering*, Vol. 124, pp. 586-595

- F30.** (2002) M.A. Haider, S. Venakides and S.P. Shipman, Boundary-integral calculations of two dimensional electromagnetic scattering in infinite photonic crystal slabs: Channel defects and resonances, *SIAM Journal on Applied Mathematics*, Vol. 62, No. 6, pp. 2129-2148
- F29.** (2000) M.A. Haider and F. Guilak, An axisymmetric boundary integral model for incompressible linear viscoelasticity: Application to the micropipette aspiration contact problem, *Journal of Biomechanical Engineering*, Vol. 122, No. 3, pp. 236-244
- F28.** (2000) S. Venakides, M.A. Haider and V. Papanicalou, Boundary integral calculations of 2-d electromagnetic scattering by photonic crystal Fabry-Perot structures, *SIAM Journal on Applied Mathematics*, Vol. 60, No. 5, pp. 1686-1706
- F27.** (2000) S. Venakides, M.A. Haider and V. Papanicolaou, Wave propagation in photonic crystal media, in *Scattering Theory and Biomedical Engineering Modelling and Applications* (eds. C. Dassios et al.), World Scientific, New Jersey, pp. 120-134
- F26.** (1999) M.M. Beaky, J.B. Burk, H.O. Everitt, M.A. Haider and S. Venakides, Two dimensional photonic crystal Fabry-Perot resonators with lossy dielectrics, *IEEE Transactions on Microwave Theory and Techniques*, Vol. 47, No. 11, pp. 2085-2091
- F25.** (1997) M.A. Haider and M.H. Holmes Analytic approximations to the deformation of a thin compressible elastic layer by a rigid flat indenter, in *Applied Mathematics: Methods and Applications* (ed. G. Oyibo), pp. 257-288, Nova Science
- F24.** (1997) M.A. Haider and M.H. Holmes, A mathematical approximation for the solution of a static indentation test, *Journal of Biomechanics*, Vol. 30, pp. 747-752
- F23.** (1997) M.A. Haider and M.H. Holmes, Three dimensional viscoelasticity in finite strain: Formulation of a rate-type constitutive law consistent with dissipation, *IMA Volumes in Mathematics and its Applications*, Vol. 98, pp. 67-88
- F22.** (1996) M.A. Haider and M.H. Holmes, Analytic approximations to the deformation of a thin elastic layer by a rigid flat indenter, *Nova Journal of Mathematics, Game Theory and Algebra*, Vol. 5, pp. 1-32
- F21.** (1995) M.A. Haider and M.H. Holmes, Indentation of a thin compressible elastic layer: Approximate analytic and numerical solutions for rigid flat indenters, *Journal of the Mechanics and Physics of Solids*, Vol. 8, pp. 1199-1219.

Thesis

F20. (1996) M.A. Haider, *Analytic Approximations for the Indentation of a Thin Linear Elastic Layer and a Viscoelastic Formulation in Finite Strain with Applications to the Mechanics of Biological Soft Tissues*, PhD Thesis, Rensselaer Polytechnic Institute, Troy, NY.

Peer-reviewed conference proceedings

- F19.** (2017) LM Paun, MU Qureshi, M Colebank, MA Haider, MS Olufsen, NA Hill, D Husmeier, Parameter inference in the pulmonary blood circulation of mice, *Proceedings of the 32nd International Workshop on Statistical Modeling (IWSM)*, Groningen, Netherlands, 3-7 July 2017, 4 pages, submitted
- F18.** (2017) M.U. Qureshi, M.A. Haider, N.C. Chesler and M.S. Olufsen, Simulating the effects of hypoxia on pulmonary hemodynamics in mice, *Proceedings of the 5th International Conference on Computational and Mathematical Biomedical Engineering*, 10-12 April 2017, 4 pages
- F17.** (2010) D. Valdez-Jasso, D. Bia, M.A. Haider, Y. Zocalo, R.L. Armentano and M.S. Olufsen, Linear and nonlinear viscoelastic modeling of ovine aortic biomechanical properties under in vivo and ex vivo conditions, *Proceedings of the 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, 4 pages
- F16.** (2010) E. Kim, F. Guilak and M.A. Haider, Determination of in situ articular cartilage pericellular matrix properties via inverse BEM analysis of chondron deformation, *Proceedings of the ASME 2010 Summer Bioengineering Conference*, abstract 19308, Naples, FL, June 16-19, 2010, 2 pages

- F15.** (2009) D. Valdez-Jasso, M.A. Haider, S.L. Campbell, D. Bia, Y. Zocalo, R.L. Armentano and M.S. Olufsen, Modeling viscoelastic properties of ovine arteries, *Proceedings of the ASME 2009 Summer Bioengineering Conference*, abstract 205640, Lake Tahoe, CA, June 17-21, 2009, 2 pages
- F14.** (2007) F.W. Mauldin, O.B. Davis, M.A. Haider, E.G. Lobo, T.W. Pfeiler and C.M. Gallippi, On the potential of combined ARFI and elastography to improve differentiation of material structure in viscoelastic tissue, *2007 IEEE Ultrasonics Symposium Proceedings*, 28-31 Oct. 2007, New York, NY, pp. 2040-2045
- F13.** (2006) J.H. Levy, R. Behler, M.A. Haider, J.S. Marron and C. Gallippi, Discrimination of mechanical response to ARFI excitation in a raised atherosclerotic plaque, *The 1st International Workshop on Computer Vision for Intravascular and Intracardiac Imaging* (G Unal, I Kakadiaris, G Slabaugh and A Tannebaum, Eds.), pp. 58-65
- F12.** (2006) M.A. Haider and F. Guilak, A three-dimensional poroelastic boundary element method applied to modeling biphasic cell-matrix interactions in articular cartilage, *Proceedings of the ASME 2006 Bioengineering Conference*, abstract 157465, Amelia Island, FL, June 21-25, 2006, 2 pages
- F11.** (2005) M.A. Haider, R.C. Schugart, L.A. Setton and F. Guilak, A mechano-chemical model of osmotic loading of an isolated chondron, *Proceedings of the ASME 2005 Summer Bioengineering Conference*, ASME, abstract 168184, Vail, CO, June 22-26, 2005, 2 pages
- F10.** (2005) M.A. Haider, D.L. Nettles, K. Trabbic-Carlson, A. Chilkoti and L.A. Setton, Predictive modeling of polypeptide hydrogel mechanical properties for cartilage repair using artificial neural networks, *Proceedings of the ASME 2005 Bioengineering Conference*, ASME, abstract 173514, Vail, CO, June 22-26, 2005, 2 pages
- F9.** (2003) M.A. Haider, S. Beun, J. Latulippe and F. Guilak A spherical biphasic model for radial deformation in a chondron, *Proceedings of the Bioengineering Conference*, ASME, pp. 569-570
- F8.** (2003) L.G. Alexopoulos, M.A. Haider, T.P. Vail and F. Guilak, Alterations in the mechanical properties of the human chondrocyte pericellular matrix with osteoarthritis, *Transactions of the Orthopaedic Research Society*, 28:107, 1 page
- F7.** (2002) L.G. Alexopoulos, M.A. Haider and F. Guilak, The mechanical role of the chondrocyte pericellular matrix in articular cartilage: Micropipette aspiration of mechanically isolated chondrons, *Proceedings of the 3rd European Symposium in Biomedical Engineering and Medical Physics*, pp. 7-8
- F6.** (2002) F. Guilak, L. Alexopoulos, R. Nielsen, H. Ting-Beall and M.A. Haider, The biomechanical properties of the chondrocyte pericellular matrix: Micropipette aspiration of mechanically isolated chondrons, *Transactions of the of the Orthopaedic Research Society*, 27:405
- F5.** (2001) L.G. Alexopoulos, M.A. Haider and F. Guilak, An axisymmetric elastic layered half-space model for micropipette aspiration of the chondrocyte pericellular matrix, *BED-Advances in Bioengineering-Proceedings of the 2001 Bioengineering Conference*, ASME, Vol. 51, 2 pages
- F4.** (1999) M.A. Haider and F. Guilak, A viscoelastic boundary element model of contact in the micropipette aspiration test, *BED-Advances in Bioengineering-Proceedings of the 1999 Bioengineering Conference*, ASME, 42:339-340
- F3.** (1998) MA Haider and F Guilak, Boundary element analysis of contact problems in cartilage cell mechanics, in "Modeling and Simulation Based Engineering" (Eds. S.N. Alturi and P.E. O'Donoghue), *Proceedings of the International Conference on Computational Engineering Science*, Atlanta, GA, Oct. 1998, II:1769-1774, Tech Science Press
- F2.** (1994) M.H Holmes and M.A. Haider, The role of matrix viscoelasticity and fluid flow in the compressive behavior of cartilage, *Proceedings of the Second World Congress of Biomechanics*, II: 29, Stichting
- F1.** (1994) M.A. Haider and M.H. Holmes, An approximation to the steady-state deformation of articular cartilage under indentation, *Proceedings of the Second World Congress of Biomechanics*, II: 214, Stichting.

Unrefereed Papers & Technical Reports

(2021) TM Andrew, JD Nance and MA Haider, A Markov chain surrogate model for a two-dimensional interacting particle system with internal collisions, arXiv, 15 pages

(2018) *Twenty-fifth Industrial Mathematical and Statistical Modeling Workshop for Graduate Students* (Edited by P Gremaud, MA Haider (chair), ICF Ipsen and RC Smith), CRSC-TR20-01, 154 pages

(2018) *Twenty-fourth Industrial Mathematical and Statistical Modeling Workshop for Graduate Students* (Edited by P Gremaud, MA Haider (chair), ICF Ipsen and RC Smith), CRSC-TR19-05, 119 pages

(2017) *Twenty-third Industrial Mathematical and Statistical Modeling Workshop for Graduate Students* (Edited by P Gremaud, MA Haider (chair), ICF Ipsen and RC Smith), CRSC-TR17-19, 141 pages

(2006) *Twelfth Industrial Mathematical and Statistical Modeling Workshop for Graduate Students* (Edited by A Chertock, MA Haider, MS Olufsen and R Smith), CRSC-TR06-23, 167 pages

(2005) *Eleventh Industrial Mathematical and Statistical Modeling Workshop for Graduate Students* (Edited by RT Buche, MA Haider, RC Smith and HT Tran), CRSC-TR05-46, 145 pages.

G. RESEARCH DIRECTION

PhD students – Current

[*Chair*] Sam Thornton (PhD, Applied Math, expected graduation Summer 2027)

[*Chair*] Julia Sanger (PhD, Math, expected graduation Summer 2027)

[*Co-Chair*] Kamala Dadashova (PhD, Applied Math, expected graduation Summer 2024)

PhD students – Graduated

[*Chair*] Katherine Pearce (PhD, 2022, Applied Math)

- Post-PhD position: Peter O'Donnell Jr. Postdoc Fellowship at Oden Inst., UT-Austin

[*Chair*] Mallory McMahon (PhD, 2020, Applied Math)

- Post-PhD position: Senior Data Scientist, Red Hat, Raleigh, NC

[*Chair*] Tricity Andrew (PhD, 2020, Applied Math), NSF GRFP awardee

- Post-PhD position: Post-Doc, Physics Dept, NCSU

[*Chair*] Micaela Mendlow (PhD, 2020, Applied Math)

- Post-PhD position: Computational Scientist, Translational Imaging Innovations

[*Chair*] Christine Mennicke (PhD, 2020, Applied Math), NSF GRFP awardee

- Post-PhD position: Pricing Analyst, National Indemnity Co., Omaha, NE

[*Co-Chair*] Christina Battista (PhD, 2015, Applied Math, with M. Olufsen)

- Post-PhD position: Post-Doc, Hamner Institute, RTP, NC

[*Chair*] Ahlam Elashgh (PhD, 2015, Applied Math), returned to Libya

[*Chair*] Amanda Mangum (PhD, 2014, Biomathematics)

- Post-PhD position: Assistant Professor (tenure track), Mathematics Dept., Niagara Univ.

[*Chair*] Janine Haugh (PhD, 2010, Applied Math)

- Post-PhD position: Assistant Professor (tenure track), Dept. of Mathematics, UNC-Asheville

[*Co-Chair*] Daniela Valdez-Jasso (PhD, 2010, Biomathematics, with M. Olufsen)

- Post-PhD position: Research Associate, Cardiovascular Biomechanics Laboratory, Dept. of Bioengineering & McGowan Institute for Regenerative Medicine, Univ. of Pittsburgh

[*Chair*] Eunjung Kim (PhD, 2009, Applied Math)

- Post-PhD position: Postdoctoral Research Associate, Dept. of Mathematics & Interdisciplinary Center for the Study of Biocomplexity, University of Notre Dame

[Chair] Sarah Olson (PhD, 2008, Biomathematics)

- Post-PhD position: (2008-11) VIGRE Postdoctoral Fellow, Mathematics Department, Tulane University

[Chair] Brandy Benedict (PhD, 2008, Applied Math with Computational Math concentration)

- Post-PhD position: Assistant Professor (tenure track), Dept. of Mathematics, Merrimack College

[Chair] Richard Schugart (PhD, 2005, Applied Math)

- Post-PhD position: Postdoctoral Fellow, Mathematical Biosciences Institute, Ohio State University

MS students - Graduated

[Co-Chair] Dominic Pafundi (MS, 2015, Applied Math)

[Chair] Katherine Henry (MS, 2013, Applied Math)

[Chair] Amanda Smith (MS, 2012, Applied Math)

[Co-Chair] Daniela Valdez-Jasso (MS, 2008, Applied Math)

[Chair] Carrie Ward (MS, 2005, Applied Math)

Postdoctoral fellows

M. Umar Qureshi (secondary advisor), 2015-18

Andreas Aristotelous (SAMSI post-doc, co-mentor), 2011-14

Zhengzheng Hu (NSF RTG post-doc, co-mentor), 2009-12

Michael Stuebner (NSF RTG post-doc, co-mentor), 2008-10

Undergraduate research students

- Erica Council, NCSU AMA undergraduate (Summer 2022)
- Cindy Nguyen, NCSU BME undergraduate (Summer 2022)
- Timothy Wessler, NCSU math undergraduate (Fall 2010-Summer 2012)
- Jeff Olander, NCSU math undergraduate (Spring 2008-Summer 2009)
- Project Faculty, 2010 NCSU summer *REU Program in Modeling and Industrial Applied Mathematics*, Project: "Tissue engineering of the intervertebral disc," 4 students
- Project Faculty, 2009 NCSU summer *REU Program in Modeling and Industrial Applied Mathematics*, Project: "Modeling ultrasound imaging in cardiovascular tissue," 3 students
- Project Faculty, 2008 NCSU summer *REU Program in Modeling and Industrial Applied Mathematics*, Project: "Mathematical modeling of cartilage regeneration via hydrogels," 5 students
- Project Faculty, 2007 NCSU summer *REU Program in Modeling and Industrial Applied Mathematics*, Project: "Monte Carlo simulation of diffusion in hyaluronan-based scaffolds with applications to tissue engineering of articular cartilage," 3 students
- Project Faculty, 2006 NCSU summer *REU Program in Modeling and Industrial Applied Mathematics*, Project: "Mechano-chemical models for chondron deformation in articular cartilage subject to osmotic loading," 3 students

H. PRESENTATIONS

Invited Talks - Conferences & Workshops

(2023) “Parameter identifiability analysis and model reduction for data-driven models of biological soft tissues,” *13th AIMS Conference on Dynamical Systems, Differential Equations and Applications – May 31-June 4, 2023*, Special Session on “Dynamics of biological materials across scales”, 6/2/23, Wilmington, NC [in person]

(2022) “Modeling biological soft tissues,” invited participant at *NSF Workshop on Models for Uncovering Rules and Unexpected Phenomena in Biological Systems (MODULUS)*, George Mason University, Fairfax VA, August 11-12, 2022 [lightning talk, in person]

(2022) “Coupled emulation of poroelastic deformation and fluid pressurization in biomechanical models of articular cartilage,” *2022 SIAM Conference on Uncertainty Quantification*, minisymposium on “Emulation for coupled multiphysics systems,” Atlanta, GA, April 12-14, 2022, virtual via Zoom

(2020) “Development of a robust structural vessel wall model and pressure-area relation for pulmonary cardiovascular networks in the presence of hypertension,” *SIAM Life Sciences Conference*, minisymposium on “Analysis of Physiological Data” 7/1/2020, virtual via Zoom

(2018) “Nonlinear elastic vessel wall models for studying pulmonary hypertension in cardiovascular networks,” *Frontiers in Mathematical Biology: Modeling, Computation & Analysis Conference*, Univ. of Central Florida, Orlando, May 2-4, 2018

(2018) “Branching random walk models for cell differentiation in developmental neurobiology,” AMS Special Session on *Algebraic, Discrete, Topological and Stochastic Models in Math Biology*, 2018 Joint Math Meetings, San Diego, CA, January 10-13, 2018

(2017) “Fast algorithms for integral equation models of viscoelasticity in biological soft tissues,” minisymposium on *Computational methods in interfacial dynamics*, 41st SIAM Southeastern Atlantic Section (SIAM-SEAS) Conference, Florida State University, Tallahassee, FL, March 18-19, 2017

(2016) “Biomass and water accumulation in plant cells during fruit growth,” *The Thirteenth Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, 6/7/16

(2014) “Modeling cartilage tissue engineering in cell-seeded scaffolds,” Minisymposium on *Modeling and simulation of complex biological systems*, 2014 SIAM Conference on the Life Sciences, Charlotte, NC, August 4-7, 2014

(2013) “Mathematical and computational mixture models for cartilage regeneration in cell-seeded scaffolds,” *12th U.S. National Congress on Computational Mechanics*, Special Session on “Cartilage Mechanics: Characterization & Computational Modeling,” Raleigh NC, July 22-25, 2013

(2012) “Continuum mixture models for cartilage tissue engineering in cell-seeded scaffolds,” *2012 Canadian Applied & Industrial Mathematics Annual Meeting*, special session on “Mathematical Biology & Medicine,” University of Toronto, June 24-28, 2012

(2012) “Cell-substrate interactions in orthopaedic tissue engineering,” *The Ninth Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, 6/5/12

(2012) “Porous mixture models for cartilage regeneration in cell-seeded scaffolds,” *4th International Conference on Porous Media*, Purdue University, May 14-16, 2012, invited talk in minisymposium on “Biological Porous Media”

(2012) “Bridging cell and tissue scale models for cell-matrix interactions in articular cartilage,” *SAMSI UQ Transition Workshop*, RTP, May 21-23, 2012

(2011) “Mixture models for cartilage tissue engineering using cell-seeded scaffolds,” *AMS Fall Southeastern Section Meeting*, Special Session on “Applications of Difference and Differential Equations

to Biology,” Wake Forest University, Winston-Salem, NC, Sep. 24-25, 2011

(2010) “Mechano-chemical models of ionic effects in the cellular microenvironment of articular cartilage,” *2010 SIAM Annual Meeting*, Minisymposium on “Fluids with Dynamic Microstructure,” Pittsburgh, PA, July 12-16, 2010

(2010) “Continuum mixture models of biomechanical cell-matrix interactions in articular cartilage,” *2010 InterPore Conference and Annual Meeting*, Texas A&M University, College Station, TX, March 14-17, 2010, invited talk [single track conference]

(2009) “Axisymmetric elastic BEM for in situ determination of articular cartilage micromechanical properties,” *10th U.S. National Congress on Computational Mechanics*, Special Session on “Computational Bioengineering,” Columbus, OH, July 16-19, 2009

(2008) “Multiphase models of cell-matrix interactions in articular cartilage,” Minisymposium on “Analysis and Simulations of Technological and Biological Complex Fluids,” *2008 SIAM Annual Meeting*, San Diego, CA, July 7-11, 2008

(2008) “Turning gels into cartilage: modeling tissue regeneration in cell-seeded scaffolds,” *The Fifth Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, 6/10/08

(2007) “Poroelastic BEMs for modeling biphasic mechanics of cell-matrix interactions in articular cartilage,” *9th U.S. National Congress on Computational Mechanics*, Special Session on “Computational Methods in Bioengineering,” San Francisco, CA, July 23-26, 2007

(2007) “Continuum mixture models of the cellular microenvironment in articular cartilage,” *Applications of Analysis to Mathematical Biology Conference*, Duke University, 5/21/07

(2007) “Biphasic poroelastic models for deformation in the cellular microenvironment of articular cartilage,” *2007 SIAM Conference on Mathematical and Computational Issues in the Geosciences*, Minisymposium on “Flow and Deformation Processes in Porous Media,” Santa Fe, NM, March 19-22, 2007

(2006) “Multiscale biphasic continuum mixture models of the pericellular microenvironment in articular cartilage,” *2006 AMS Fall Central Sectional Meeting*, Special Session on “Mathematical Modeling of Biological Systems,” University of Cincinnati, Cincinnati, OH, 10/21/06

(2006) “Optimal design of biocompatible materials for cartilage repair,” *The Third Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, 6/6/06

(2005) “Mechano-chemical modeling of the local cellular environment in articular cartilage,” *2005 SIAM Annual Meeting*, Minisymposium on “Biological and Chemical Modeling with Applications,” July 2005, New Orleans, LA

(2004) “Time reversal numerical simulations for randomly layered media,” *4th SIAM Conference on Mathematical Aspects of Materials Science*, Minisymposium on “Light and Wave Propagation in Inhomogeneous Media: Theory and Modeling,” May 2004, Los Angeles, CA

(2003) “Mixture models of cell-matrix mechanics in articular cartilage and alterations with osteoarthritis,” *2003 AMS Fall Southeastern Section Meeting*, Special Session on “Mathematical Modeling in Physiology and Medicine,” October 2003, Chapel Hill, NC

(2003) “A radial biphasic model for local cell-matrix mechanics in articular cartilage,” *2003 Spring Southeastern Sectional Meeting of the AMS*, Special Session on “Applied Mathematics and Materials Science,” March 2003, Baton Rouge, LA

(2002) “A time-marching boundary element method for standard linear viscoelasticity,” *International Conference on Mathematics and Biology and 2002 Annual Meeting of the Society for Mathematical Biology*, Minisymposium on “Computational Biofluid Dynamics,” July 2002, Knoxville, TN

(1999) “A viscoelastic boundary element model of contact in the micropipette aspiration test,” *ASME Summer Bioengineering Conference*, Symposium on “Cell and Tissue Engineering,” June 1999, Big Sky, MT

(1998) “Boundary element analysis of contact problems in cartilage cell mechanics,” *International Conference on Computational Engineering Science*, Special Session on “Contact Mechanics,” October 1998, Atlanta, GA

(1995) “Analytic approximations to the deformation of a thin compressible elastic layer by a rigid flat indenter,” Workshop on *Applied Mathematics: Methods and Applications*, Winter, 1995, Troy, NY

Invited Talks - External Colloquia & Seminars

(2023) “Local identifiability analysis approaches for mathematical modeling of biological soft tissues,” UNC Applied Math Colloquium, 11/6/2023, in person

(2021) “Mathematical modeling of biological soft tissues,” Math, Physics & CS Conversation Series Talk, Roanoke College, 3/31/2021, virtual talk

(2021) “Data-driven modeling of fibrin polymerization kinetics in a biomimetic wound healing system”, Graduate Student Seminar, Western Kentucky University, 3/26/2021, virtual talk

(2018) “Mathematical models for extracellular matrix regeneration and remodeling in biological soft tissues,” Applied Math Seminar, University of Waterloo, Canada, 11/15/18

(2018) “Development and calibration of mathematical models for matrix accumulation and remodeling in biological soft tissues,” Joint IMSE/BME Seminar, Washington University, St. Louis, 11/5/18

(2018) “Mathematical models for extracellular matrix regeneration in cell-seeded scaffolds & progenitor cell lineages in developmental neurobiology,” Dept. of Orthopaedics, Washington University, St. Louis, 11/2/18

(2018) “A hybrid-discrete reaction-diffusion model for cartilage tissue engineering via cell-seeded scaffolds,” Applied Maths Seminar, School of Mathematics & Statistics, University of Glasgow, 5/23/18

(2018) “Mathematical models for matrix regeneration and remodeling in biological soft tissues,” Math Biology & Ecology Seminar, Georgia Tech, Atlanta, GA, 1/31/2018

(2017) “Mathematical models for matrix regeneration and remodeling in biological soft tissues,” Biomathematics Seminar, Virginia Commonwealth University, 9/22/2017

(2016) “Continuum mixture models for extracellular matrix regeneration in cartilage tissue engineering,” SoftMech research seminar, School of Mathematics & Statistics, Univ. of Glasgow, 9/21/16

(2015) “Mathematical modeling of extracellular matrix regeneration in cartilage tissue engineering,” Colloquium, College of the Holy Cross, Dept. of Mathematics and Computer Science, 11/18/15

(2011) “Mixture models for cartilage tissue engineering in biomaterial scaffolds seeded with chondrocytes,” Mathematical Sciences Colloquium, Worcester Polytechnic Institute, 11/18/11

(2011) “Mixture models for cartilage tissue engineering in biomaterial scaffolds seeded with chondrocytes,” Duke University Mathematical Biology Colloquium, 9/23/11

(2010) “Mathematical modeling of cell-matrix interactions in natural and tissue engineered articular cartilage,” Colloquium and SIAM Student Chapter Seminar, University of Tennessee, 4/30/10

(2009) “Mathematical modeling of cell-matrix interactions in articular cartilage,” Mathematics Department Colloquium, Tulane University, 1/29/09

(2007) “Multiphasic models of cell-matrix interactions in articular cartilage,” Applied Math Colloquium, UNC-Chapel Hill, 10/26/07

(2006) “The role of mechanics in osteoarthritis: modeling the cellular microenvironment in articular cartilage,” Seminar, Mathematical Biosciences Institute, Ohio State University, 10/23/06

(2005) “Mechanical and chemical models of the pericellular microenvironment in articular cartilage,” Duke Applied Math & Analysis Seminar, 11/28/05

(2002) “Modeling the role of the pericellular matrix in cartilage mechanics,” Cell Mechanics Group Seminar, Duke University Medical Center, May 2002

- (1999) “Boundary integral computations of electromagnetic scattering in photonic crystal structures,” Dept. of Mathematics and Statistics, Simon Fraser University, February 1999
- (1999) “Boundary integral computations of electromagnetic scattering in photonic crystal structures,” Dept. of Mathematics and Statistics, University of Maryland-Baltimore County, February 1999
- (1999) “Boundary integral computations of electromagnetic scattering in photonic crystal structures,” Dept. of Mathematics and Statistics, Bowling Green State University, February 1999
- (1999) “Boundary integral computations of electromagnetic scattering in photonic crystal structures,” Dept. of Mathematics, NCSU, February 1999
- (1998) “Contact problems for assessing cartilage matrix and cell mechanical properties,” Dept. of Applied Mathematics, University of Western Ontario, March 1998
- (1998) “Contact problems for assessing cartilage matrix and cell mechanical properties,” Dept. of Mathematical Sciences, Worcester Polytechnic Institute, February 1998
- (1998) “Contact problems for assessing cartilage matrix and cell mechanical properties,” Dept. of Mathematics and Statistics, McMaster University, February 1998
- (1997) “Approximate solution of a contact problem in soft tissue biomechanics,” Dept. of Applied Mathematics, University of Washington (Seattle), January 1997
- (1997) “Approximate solution of a contact problem in soft tissue biomechanics,” Dept. of Mathematics, Harvey Mudd College, February 1997

Contributed Presentations - Conferences & Workshops

- (2022) “Parameter identifiability and subset selection techniques for data-driven model reduction with applications to biological soft tissues,” *2022 SIAM Conference on the Life Sciences*, contributed session on “Data Driven Modeling,” July 11-14, 2022, Pittsburgh, PA (in person talk)
- (2022) “Experiences in offering a new undergraduate course in mathematical foundations of data science,” contributed talk in session on “Data and Computing Pedagogy,” *2022 SIAM Conference in Applied Mathematics Education*, July 11-12, 2022, Pittsburgh, PA [in person talk]
- (2019) “Modeling fluid-solid dynamics of cardiovascular networks in the presence of pulmonary hypertension,” *4th Soft Tissue Modeling Workshop*, University of Glasgow, June 5-7, 2019 (virtual talk)
- (2019) “Reduced order modeling of a biphasic cartilage mixture model under dynamic compressive loading,” *SAMSI MUMS Transition Workshop and SPUQ Conference*, UNC-Chapel Hill, May 14-17, 2019 (talk)
- (2018) “Application of the HGO Model to Capturing the Pressure-Area Relationship in a Large Murine Pulmonary Artery under Pulsatile Flow,” *8th World Congress of Biomechanics*, Dublin, Ireland, July 8-12, 2018 (poster)
- (2017) “Incorporating vessel wall remodeling into 1D cardiovascular network models of pulmonary hypertension,” *2017 Biology and Mathematics Through Medicine Conference*, Virginia Commonwealth University, May 18-20, 2017 (talk)
- (2017) “A phenomenological mixture model for growth of tissue engineered cartilage in cell-seeded scaffolds,” *2017 Biology and Mathematics Through Medicine Conference*, Virginia Commonwealth University, May 18-20, 2017 (poster)
- (2017) “Modeling cell proliferation in the transition from neurogenesis to gliogenesis,” *2017 Biology and Mathematics Through Medicine Conference*, Virginia Commonwealth University, May 18-20, 2017 (poster)
- (2016) “Stochastic modeling of cell proliferation and differentiation in developmental neurobiology,” *MBI Workshop Population Models in the 21st Century*, November 14-18, 2016 (poster)
- (2016) “Models and algorithms for 3D corneal biometry from optical coherence tomography,” *SIAM Conference on Imaging Science*, Albuquerque, NM, May 23-26, 2016 (poster)

- (2015) “Mixture models for cartilage extracellular matrix regeneration in cell-seeded scaffolds,” *SMB Annual Meeting*, Atlanta, GA, June 3-July 3, 2015, (talk)
- (2014) “Computational model for optical coherence tomography imaging of the human eye,” *MBI Workshop on Integrating Modalities and Scales in Life Science Imaging*, March 17-21, 2014 [poster]
- (2012) “Bridging cell and tissue scale models for nutrient diffusion and uptake in articular cartilage,” 2012 SIAM Conference on the Life Sciences, Aug 7-10, 2012, San Diego, CA (poster)
- (2010) “A fast quadrature-based numerical method for the continuous spectrum biphasic poroviscoelastic model of articular cartilage,” *2010 SIAM Conference on the Life Sciences*, July 12-15, 2010, Pittsburgh, PA (poster)
- (2010) “Determination of in situ articular cartilage pericellular matrix properties via inverse BEM analysis of chondron deformation,” Poster session on “Musculoskeletal Soft Tissues,” *2010 Summer Bioengineering Conference*, June 16-19, 2010, Naples, FL (poster)
- (2010) “Biomechanics of the cellular microenvironment in articular cartilage,” *34th SIAM Southeastern-Atlantic Section Annual Meeting*, Minisymposium on “Modeling in biomechanics and bioengineering,” 3/20/10, Raleigh, NC (talk)
- (2009) “Modeling viscoelastic properties of ovine arteries,” *2009 Summer Bioengineering Conference*, June 17-21, Lake Tahoe, CA (poster)
- (2008) “Mechano-chemical models of swelling in the microscopic environment of articular cartilage,” minisymposium on “Swelling Porous Materials”, *2008 SIAM Conference on Mathematical Aspects of Materials Science*, May 11-14, 2008, Philadelphia, PA (talk)
- (2007) “Artificial neural network modeling of structure-function relationships for ELP hydrogels in the cartilage repair problem,” *IMA Annual Program on Applications of Algebraic Geometry, Workshop on Applications in Biology, Dynamics and Statistics*, March 5-9, 2007, Minneapolis, MN (poster)
- (2007) “Modeling articular cartilage regeneration using hydrogel scaffolds,” *Applications of Analysis to Mathematical Biology Conference*, Duke University, 5/21/07 (poster)
- (2006) “A three-dimensional poroelastic boundary element method applied to modeling biphasic cell-matrix interactions in articular cartilage,” *2006 Summer Bioengineering Conference*, June 21-25, 2006, Amelia Island, FL (podium talk)
- (2005) “A mechano-chemical model of osmotic loading of an isolated chondron,” *2005 Summer Bioengineering Conference*, June 22-26, 2005, Vail, CO (podium talk)
- (2005) “Predictive modeling of polypeptide hydrogel mechanical properties for cartilage repair using artificial neural networks,” *2005 Summer Bioengineering Conference*, June 22-26, 2005, Vail, CO (podium talk)
- (2004) “Mechano-chemical properties of articular chondrocytes under osmotic loading,” *2004 BMES Annual Fall Meeting*, Philadelphia, PA, October 2004, (podium talk)
- (2004) “Modeling mechanotransduction in articular cartilage: The role of the pericellular matrix,” *2004 SIAM Conference on the Life Sciences*, Minisymposium on “Mathematical Modeling of the Musculoskeletal System,” July 2004, Portland, OR (talk)
- (2004) “Osmotic loading of articular cartilage cells using triphasic theory,” *2004 SIAM Conference on the Life Sciences*, July 2004, Portland, OR (poster)
- (2004) “A biphasic model for local cell-matrix mechanics in articular cartilage”, *4th SIAM Conference on Mathematical Aspects of Materials Science*, May 2004, Los Angeles, CA (poster)
- (2003) “Numerical method for time-reversal of waves in random media,” *SIAM Conference on Computational Science and Engineering*, February 2003, San Diego, CA (poster)
- (2002) “Integral equation models of cell mechanics in articular cartilage,” *First SIAM Conference on the Life Sciences*, March 2002, Boston, MA (poster)

- (2000) “Boundary integral model for 2-D electromagnetic scattering by photonic crystal structures,” *3rd SIAM Conference on Mathematical Aspects of Materials Science*, May 2000, Philadelphia, PA (talk)
- (1999) “Boundary integral model of the micropipette aspiration contact problem,” *IMA Workshop on Computational Modeling in Biological Fluid Dynamics*, January 1999, Minneapolis, MN (poster)
- (1998) “A computational model for mechanical testing of individual cartilage cells,” *SIAM Annual Meeting*, July 1998, Toronto, Canada (talk)
- (1994) “The role of matrix viscoelasticity and fluid flow in the compressive behavior of cartilage,” *Second World Congress of Biomechanics*, July 1994, Amsterdam (podium talk)
- (1994) “An approximation to the steady-state deformation of articular cartilage under indentation,” *Second World Congress of Biomechanics*, July 1994, Amsterdam (podium talk)

Internal Talks

- (2020) “Mathematical models for extracellular matrix regeneration and remodeling in biological soft tissues,” Complex Matter & Biophysics seminar, NCSU Physics Dept., 2/27/2020
- (2017) “Modeling and remodeling in biological soft tissues,” SUM Series talk, 11/2/17
- (2017) “Exploiting analytical structure to develop accelerated numerical solutions in continuum modeling of materials,” SIAM Student Chapter, 4/19/17
- (2017) “What is applied math?” Girls in Applied Math, Modeling & Analysis (GAMMA) Day, 4/18/17
- (2013) “Mathematical and computational mixture models for cartilage regeneration in cell-seeded scaffolds,” Biomathematics Seminar, NCSU, 12/3/13
- (2013) “Mathematical modeling of cartilage tissue engineering,” SUM Club talk, 11/20/13
- (2011) “A fast quadrature-based numerical method for the continuous spectrum biphasic poroviscoelastic model of articular cartilage,” Numerical Analysis Seminar, NCSU, 1/25/11
- (2009) “Computational models for biomechanics of the pericellular matrix in articular cartilage,” Numerical Analysis Seminar, NCSU, 3/10/09
- (2007) “Continuum mixture models for mechanics in the cellular microenvironment of articular cartilage,” Mechanics and Materials Seminar, NCSU, 2/21/07
- (2007) “Finite element models of biphasic deformation in the cellular microenvironment of articular cartilage,” Numerical Analysis Seminar, NCSU, 2/13/07
- (2006) “Artificial neural networks for analysis of cartilage repair using hydrogel scaffolds,” Biomathematics Seminar, NCSU, 11/7/06
- (2005) “An accelerated numerical method for the continuous spectrum biphasic poroviscoelastic model of articular cartilage,” Numerical Analysis Seminar, NCSU, September 2005
- (2003) “The role of cartilage mechanics in osteoarthritis: models and experiments,” Biomathematics Seminar, NCSU, April 2003
- (2002) “Numerical simulation of time reversal for waves in random media,” Numerical Analysis Seminar, NCSU, December 2002
- (2002) “Modeling the role of the pericellular matrix in cartilage mechanics,” Numerical Analysis Seminar, NCSU, April 2002
- (2001) “Boundary integral models of 2-D electromagnetic scattering in photonic crystals,” VISTA Seminar, Dept. of Electrical and Computer Engineering, NCSU, April 2001
- (2000) “A boundary integral model for mechanical testing of individual cartilage cells,” Numerical Analysis Seminar, NCSU, February 2000
- (1998) “Boundary integral model for mechanical testing of individual cartilage cells,” Scientific Computation and Applied Mathematics Seminar, Duke University, October 1998
- (1997) “Viscoelastic modeling of biological soft tissues,” Dept. of Civil Engineering, Duke University, March 1999

(1996) “Approximate solution of a contact problem in soft tissue biomechanics,” Scientific Computation and Applied Mathematics Seminar, Duke University, October 1996

Training & Outreach

- (2023) Faculty panelist, “How to apply to graduate school: nuts and bolts,” Graduate Research Opportunities Workshop (GROW), Duke University, 10/21/23
- (2023) Panelist, “Navigating data science career opportunities,” dinner panel, Data Science Career Graph, NCSU Data Science Academy, 10/17/23
- (2020) Co-organizer, SAMSI virtual panel on “US National Lab & Government Agency Careers for Graduate Students,” 5/19/2020
- (2020) Co-organizer, SAMSI virtual panel on “Industry Careers for Graduate Students,” 6/2/2020
- (2020) Co-organizer, SAMSI virtual panel on “Professional Masters Degrees,” 7/21/2020
- (2020) Co-organizer, SAMSI virtual panel on “Applying to Doctoral Programs in Statistics and Mathematics,” 7/28/2020
- (2019) Faculty panelist for *MSRI Academic Sponsors Day* panel on “How to train graduate students and postdocs to work in and collaborate with researchers in Business, Industry & Government,” MSRI, UC-Berkeley, 3/6/2020
- (2019) Faculty panelist for NCSU SIAM Student Chapter event on Academic Job Hiring, 11/21/19
- (2019) Faculty panelist for NCSU Math Undergraduates Under Graduates (UUG) event on Graduate School Applications, 11/6/19
- (2019) Panelist for session on “Graduate School Applications”, *Diversity in Data Science and Machine Learning Conference*, Howard University, Washington DC, Oct 17-18, 2019
- (2017) “What is Applied Math,” lecture at Girls in Applied Math, Modeling and Analysis (GAMMA) Day, Dept. of Mathematics, NCSU, 4/8/17
- (2015) Panelist for session on “Paths to the doctorate: finding the right graduate program for you,” *2015 Field of Dreams Conference*, Birmingham, AL, Nov. 6-8, 2015
- (2015) Panelist for session on “Preparing a Successful Grant Application,” *Joint Math Meetings*, San Antonio TX, Jan 10-13, 2015, organized by Project NEXT
- (2015) Talk on “Writing effective recommendation letters for students applying to mathematics doctoral programs,” *MAA Southeastern Section Meeting*, Project NEXT session, UNC-Wilmington, 3/12/15
- (2010) “Applied mathematics & applications to the biomechanics of orthopaedic soft tissues,” Future Scientists Club, Enloe High School, Raleigh, NC (2/25/10)
- (2008) “Cartilage regeneration,” Scope Academy, NCSU, 10/11/08 (talk to NCSU PAMS alumni)
- (2005) “Mathematical modeling applied to soft tissue biomechanics & understanding osteoarthritis,” presentation to Board of Directors, NCSU PAMS Foundation (4/15/2005)

I. CONFERENCE & WORKSHOP ORGANIZATION

- (2021) Co-Organizer, SAMSI workshop on *Data-driven Mathematical and Statistical Modeling for Graduate Students*, July 12-16, 2021, virtual due to Covid-19
- (2021) Invited Project Mentor (1 of 4), *SAMSI Virtual Undergraduate Workshop*, May 16-18, 2021
- (2019-20) Chair, *2020 SAMSI Industrial Mathematical and Statistical Modeling Workshop for Graduate Students*, NC State University, July 12-22, 2020 – replaced with a series of 5 virtual career panels between May-July 2020 due to Covid-19
- (2018-19) Chair, *2019 SAMSI Industrial Mathematical and Statistical Modeling Workshop for Graduate Students*, NC State University, July 14-24, 2019

(2017-18) Chair, *2018 SAMSI Industrial Mathematical and Statistical Modeling Workshop for Graduate Students*, NC State University, July 15-25, 2018

(2018) Organizing Committee, *42nd SIAM Southeastern Atlantic Section Conference*, Jointly sponsored by UNC-Duke-NCSU, Chapel Hill, NC, March 9-11, 2018

(2017-18) Chair, *2017 SAMSI Industrial Mathematical and Statistical Modeling Workshop for Graduate Students*, NC State University, July 16-26, 2017

(2016) Invited Mentor (1 of 4), *The Thirteenth Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, June 7-19, 2016

(2015) Minisymposium on “Multiscale models of biophysical and biomechanical effects in soft tissues,” SMB Annual Meeting, Atlanta, GA, June 3-July 3, 2015, co-organized with Sarah Olson (WPI)

(2014) Minisymposium on “Modeling arterial wall mechanics and adaption using structurally based constitutive laws,” 2014 SIAM Conference on the Life Sciences, Charlotte, NC, August 4-7, 2014 , co-organized with Mette Olufsen (NCSU)

(2012) Invited Mentor (1 of 4), *The Ninth Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, June 5-8 2012

(2010) Organizing Committee, *34th SIAM Southeastern-Atlantic Section Conference*, North Carolina State University, March 20-21, 2010

(2010) Co-organizer (with Sarah Olson, Tulane), Minisymposium on “Modeling in Biomechanics and Bioengineering,” *34th SIAM Southeastern-Atlantic Section Conference*, North Carolina State University, March 20-21, 2010, 8 speakers

(2009) Co-organizer (with Greg Forest, UNC-CH), Special Session on “Mathematical Progress and Challenges for Biological Materials,” *2009 AMS Spring Southeastern Section Meeting*, North Carolina State University, April 4-5, 2009, 13 speakers

(2008) Invited Mentor (1 of 4), *The Fifth Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, June 10-13 2008

(2008) Co-organizer (with Lynn Bennethum, UC-Denver), Minisymposium on “Swelling Porous Materials,” *2008 SIAM Conference on Mathematical Aspects of Materials Science*, Philadelphia, PA, May 2008, 8 speakers

(2005-06) Chair, *SAMSI/CRSC 12th Industrial Mathematical and Statistical Modeling Workshop for Graduate Students*, North Carolina State University, July 24-August 1, 2006

(2006) Invited Mentor (1 of 4), *The Third Annual Graduate Student Math Modeling Camp*, Rensselaer Polytechnic Institute, Troy, NY, June 6-9 2006, designed project and mentored a group of 6 graduate students for one week on the topic: “Optimal design of biocompatible materials for cartilage repair”

(2006) Organizer, Minisymposium on “Modeling in Biological Tissues,” *2006 Joint SIAM/SMB Conference on the Life Sciences*, Raleigh, NC, August 2006, 5 speakers

(2004-05) Chair, *SAMSI/CRSC 11th Industrial Mathematical and Statistical Modeling Workshop for Graduate Students*, North Carolina State University, July 25-August 2, 2005

(2004) Organizer, Minisymposium on “Mathematical Modeling in the Musculoskeletal System,” *2004 SIAM Conference on the Life Sciences*, Portland, OR, July 2004, 8 speakers

J. OTHER WORKSHOPS

(2011-12) *Statistical and Applied Mathematical Sciences Institute (SAMSI) Fellow*, 2011-12 Program on Uncertainty Quantification

(2009) Faculty Consultant, *15th SAMSI/CRSC Industrial Mathematical & Statistical Modeling Workshop for Graduate Students*, Raleigh, NC, July 19-27, 2009, Project: “Resource issues impacting national security,” Industrial sponsor: MIT-Lincoln Lab

(2008) Faculty Consultant, *14th SAMSI/CRSC Industrial Mathematical & Statistical Modeling Workshop for Graduate Students*, Raleigh, NC, July 19-28, 2008, Project: “Estimating position and velocity of flight vehicles using angle-only measurements,” Industrial sponsor: MIT-Lincoln Lab

(2007) Faculty Consultant, *23rd Annual Workshop on Mathematical Problems in Industry (MPI)*, June 11-15, 2007, University of Delaware, faculty consultant on project “Modeling diffusion in a lens capsule via fluorescence recovery after photobleaching”

(2007) IMA Annual Program on Applications of Algebraic Geometry, Workshop on *Applications in Biology, Dynamics and Statistics*, IMA, Minneapolis, MN, March 5-9, 2007

(2004) Faculty Consultant, *10th SAMSI/CRSC Industrial Mathematical & Statistical Modeling Workshop for Graduate Students*, Raleigh, NC, July 26-August 3, 2004, Project: “Identifying respiratory parameters from plethysmography data,” Industrial sponsor: CIIT Centers for Health Research

(2004) *Single Cell Mechanics Workshop*, MIT, Cambridge, MA, October 2004, attendance by invitation only

(2002) SIAM symposium on *Computational Models and Simulation for Intra-Cellular Processes*, October 2002, Washington DC

(2002) SAMSI workshop on *Inverse Problem Methodology in Complex Stochastic Models*, September 2002, Research Triangle Park, NC

(2001) *Teaching Summer Session Courses Professional Development Seminar*, Faculty Center for Teaching and Learning, NCSU

(1999) IMA Workshop on *Computational Modeling in Biological Fluid Dynamics*, IMA, Minneapolis, MN, January 1999

K. TEACHING (NCSU)

- *Undergraduate*: Calculus III (MA242), Applied Differential Equations I (MA341/H), Applied Differential Equations II (MA401), Introduction to Numerical Analysis II (MA428), Methods of Applied Math I (MA450), Methods of Applied Math II (MA451), Mathematical Foundations of Data Science (MA 493)
- *Graduate*: Numerical Solution of PDEs – Finite Element Methods (MA587), Introduction to Partial Differential Equations (MA534), Advanced Mathematics for Engineers and Scientists I&II (MA501, 502), Introduction to Complex Variables (MA513), Mathematical Modeling of Physical & Biological Processes I&II (MA 573/574)
- *Undergraduate Courses Co-developed*: Methods of Applied Math I (MA450), Methods of Applied Math II (MA451), Mathematical Foundations of Data Science (MA 493)
- *Graduate Courses Developed (special topics)*: Introduction to Boundary Integral and Fast Multipole Methods (MA797), Introduction to Perturbation Methods (MA797), Introduction to Continuum Mechanics of Elastic and Viscoelastic Solids (MA591/BMA590), Applied Modeling and Analysis Techniques (MA591), Distance Education version of Advanced Mathematics for Engineers and Scientists I (MA 501)

L. SERVICE

Departmental

- *Director, MS Program in Foundations of Data Science* (2022-Present)
- *Director of Graduate Programs in Mathematics and Applied Mathematics* (2012-16)
- *Regular Committees:* Personnel Evaluation Committee (2008-10), Faculty Advisory Committee (elected, 2005-07, 2009-11, 2014-16, 2022-24), Math Undergraduate Honors Committee (2005-12, 2019-21), PhD Prelim Exam Committee (2008-09), Computer Committee (2004-09), Graduate Recruitment Committee (2005-12), Undergraduate Course & Curriculum Committee (2003-04, 2019-23), Undergraduate Committee for Non-Majors (2003-04), Diversity, Equity & Inclusion Committee (2020-23), Post Tenure Review Committee (2022-23, Chair)
- *Hiring Committees:* General Math Hiring Committee (2007-08, 2011-12-Chair, 2021-22), Applied Analysis Hiring Committee (2010-11-Chair), Interdisciplinary Hiring Committee (2008-09), PDE Hiring Committee (2002-03, 2005-06, 2006-07), Applied Math Hiring Committee (2001-02), Teaching Assistant Professor Hiring Committee (2015-16, 2019-20), Biomathematics Hiring Committee (2020-21), General Search Hiring Committee (2021-22), Applied & Computational Math Hiring Committee (2022-23)
- *Ad-hoc Committees:* Applied Math Undergraduate BS Degree Review (2011, Chair), Interdisciplinary Mathematics Grad Program Committee (2005-06, 2009-10), Differential Equations Textbook Selection Committee (2000-01, 2007-08), Teaching Awards Committee (2007-09), Mathematics Dept. Data Science Concentration Committee (2021-23)
- *Seminars:* Applied Math Graduate Student Seminar (co-organizer: 2001-02, faculty participant: 2002-03, chair: 2003-05, co-organizer 2006-20), Numerical Analysis Seminar (organizer: 2000-01), NSF RTG program Research Training Modules (co-organizer, 2008-12)
- *REG Program:* REG Faculty Mentor (Summers 2007, 2010, 2011)
- Maintained website for NCSU NSF RTG Program on *Mathematics of Materials* (2007-12)
- Graduate Recruiting Weekend research talks (2001, 2005-07, 2010), Biomathematics Program Graduate Recruiting Weekend talks (2008, 2010, 2018, 2022)
- NCSU Mathematics Department representative at Graduate School Career Fair (for minority recruiting), *3rd Annual Iowa Mathematical Field of Dreams Conference* University of Iowa, Iowa City, IA (9/27/09)
- TA supervisor of 1-2 graduate students each semester since 1999
- Judge for DRUMS REU program 3-minute elevator speech competition, 7/9/21

University

- Member, Data Science Academy Course & Curriculum Committee (2021-23)
- Member, Data Science Academy Executive Director Hiring Committee (2020-21)
- Ad-hoc Committee for 5-year Math Department Head Review (2020-21)
- Member, CFEP Cluster Hiring Committee on “Quantitative & Computational Developmental Biology: Modeling the Living Embryo” (2015-19)
- Faculty Senate Grievance Panel Member (2016-17)
- Member, CFEP Cluster Hiring Committee on “Precision Medicine” (2012-15)
- Member, Biomathematics Graduate Admissions Committee (2007-09)
- Member, Biomedical Engineering Undergraduate Admissions Committee (2003-04)
- Chair, Biomathematics Lucas Research Award Committee (2004-05, 2007-08)

External

- SIAM Committee on Science Policy (2021-2023, 3-year term)

- SAMSI Associate Director (2018-2021), Directorate Liaison for 2 year-long research programs and Lead- or Co-organizer of summer Education & Outreach workshops
- Editorial Board, Journal of Biomechanics (2007-Present)
- Reviewer for *SIAM Journal on Applied Mathematics*, *SIAM Journal on Numerical Analysis*, *Journal of Fluid Mechanics*, *Journal of Biomechanics*, *Journal of Biomechanical Engineering*, *Biophysical Journal*, *Annals of Biomedical Engineering*, *Biomechanics & Modeling in Mechanobiology*, *Computer Methods in Applied Mechanics & Engineering*, *Osteoarthritis and Cartilage*, *Finite Elements in Analysis & Design*, *Cellular & Molecular Bioengineering*, *Journal of Theoretical Biology*, *International Journal of Solids & Structures*, *Medical Engineering & Physics*, *Scientific Reports*, *International Journal for Numerical Methods in Biomedical Engineering*, *Soft Matter*, *IMA Journal of Applied Mathematics*, *Mathematical Medicine & Biology*, *Physics in Medicine & Biology*, *Cardiovascular Engineering & Technology*, *Journal of Mathematical Biology*
- Panel reviewer for NSF programs in the Division of Mathematical Sciences (3 times) and Division of Civil, Mechanical and Manufacturing Innovation (1 time)
- Reviewed book proposal on continuum mechanics of biological materials for Cambridge University Press
- Reviewed Boyce & Brannon differential equations undergraduate textbook for Wiley
- Review Boyce & DiPrima differential equations textbook (9th Ed) for Wiley
- Reviewed 9th edition of Kreysig's "Advanced Engineering Mathematics" for Wiley & Sons
- Faculty Mentor for Uniform Admissions Process (F-GAP) at Mathematical Field of Dreams Conference (Math Alliance)- advised under-represented minority seniors in preparing their graduate school applications (2013, 2014, 2015, 2019)
- Judge, Contributed talk student competition, SMB Annual Meeting Student, June 13-17, 2021

M. PATENTS

- (2015) Co-author on U.S. Patent#9043156, "Combined Acoustic Radiation Force Impulse (ARFI) Ultrasound and Elastography and Monitored Steady State Excitation Recovery (MSSER) Ultrasound" by UNC-Chapel Hill and Siemens Corp., in collaboration with CM Gallippi (UNC-CH), EG Loba (NCSU), O Davis (NCSU) and FW Mauldin (Va Tech), approved

N. SOCIETY MEMBERSHIPS

- Society for Industrial and Applied Mathematics (SIAM), Society for Mathematical Biology (SMB), American Mathematical Society (AMS), American Society of Mechanical Engineers (ASME), American Association for the Advancement of Science (AAAS)