

NAGEHAN DEMIRCI

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EDUCATION

Ph.D. , Aerospace and Mechanical Engineering (Bioengineering) - <i>Ongoing</i> University of Notre Dame (Notre Dame, IN, USA) Advisor: Prof. Maria Holland, GPA: 3.8 / 4.0	2019-Present
Ph.D. , Bioengineering - <i>Not Completed</i> University of Illinois at Chicago (Chicago, IL, USA) Advisor: Prof. Richard Magin	2012-2014
M.Sc. , Mechanical Engineering Middle East Technical University (Ankara, Turkey) Advisor: Prof. Ergin Tonuk	2009-2012
B.S. , Mechanical Engineering Gazi University (Ankara, Turkey)	2004-2009

PUBLICATIONS

Peer-Reviewed

8. **Demirci N**, Jafarabadi F, Wang X, Wang S, Holland MA, “Consistency and variation in the placement of cortical folds: a perspective”, (submitted), 2023.
7. Consolini J, **Demirci N**, Fulwider A, Hutsler JJ, Holland MA, “Bok’s equi-volume principle: Translation, historical context, and a modern perspective.”, *Brain Multiphysics*, 2022. DOI: 10.1016/j.brain.2022.100057.
6. **Demirci N**, Hoffman ME, Holland MA, “Systematic cortical thickness patterns in primates suggest a universal physical law of folding”, (submitted), 2022.
5. **Demirci N**, Holland MA, “Cortical thickness systematically varies with curvature and depth in healthy human brains”, *Human Brain Mapping*, 2022. DOI:10.1002/hbm.25776.
4. Darayi M, Hoffman ME, Sayut J, Wang S, **Demirci N**, Consolini J, Holland MA, “Computational models of cortical folding: a review of common approaches”, *Journal of Biomechanics*, 2021. DOI: 10.1016/j.jbiomech.2021.110851.
3. Wang S, **Demirci N**, and Holland MA (2020). “Numerical investigation of biomechanically coupled growth in cortical folding”, *Biomechanics and Modeling in Mechanobiology*, DOI: 10.1007/s10237-020-01400-w.
2. **Demirci N**, Tonuk E, “Non-integer viscoelastic constitutive law to model soft biological tissues to in-vivo indentation”, *Acta of Bioengineering and Biomechanics*, 2014, Vol:16(4), p:13-21. DOI: 10.5277/ABB-00005-2014-03.
1. Bekmez S, Uzuncugil A, Kalafat E, **Demirci N**, Tonuk E, Leblebicioglu G, “Passive mechanical properties of skeletal muscle: analyzing the effects of denervation with mathematical modelling in a rabbit quadriceps model”, *Acta Medica*, 2014, Vol:3, p:68-74.

PRESENTATIONS

Conference Presentations (presenter)

11. **Demirci N**, Holland MA, “Evolution of cortical thickness and morphology throughout growth and development”. SB³C 2023: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 4-8, 2023, Vail, Colorado, USA.
10. **Demirci N**, Holland MA, “Mechanical and biological contributors to consistent cortical thickness patterns in primates”. Society of Engineering Science Annual Technical Meeting, October 16-19, 2022, College Station, Texas, USA.
9. **Demirci N**, Holland MA, “Correlation between cortical morphology and thickness due to forces generated during folding”. World Congress of Biomechanics, July 10-14, 2022, Taipei, Taiwan, Virtual Presentation.
8. **Demirci N**, Holland MA, “Cortical thickness correlates with cortical morphology among human and non-human primate brains”. SB³C 2022: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 20-23, 2022, Baltimore, Maryland, USA.
7. Wang S, **Demirci N**, Solar VC, Costabal FS, Holland MA, “Unfolding the cortex via a physics-informed graph neural network”. Ibero-Latin-American Congress on Computational Methods in Engineering and Pan American Congress on Computational Mechanics, November 9-12, 2021, Virtual Meeting.
6. Wang S, **Demirci N**, Holland MA, “Is heterogeneous cortical growth necessary to recapitulate cortical thickness patterns seen in the brain?”. U.S. National Congress of Computational Mechanics, July 25-29, 2021, Virtual Meeting.
5. **Demirci N**, Holland MA, “Cortical thickness distribution of the human cerebral cortex identified by curvature at local scales”. SB³C 2021: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 14-18, 2021, Virtual Meeting, Student Ambassador.
4. **Demirci N**, Holland MA, “Quantitative investigation of the folding patterns of the human cerebral cortex”. SB³C 2020: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 17-20, 2020, Virtual Meeting.
3. **Demirci N**, Tonuk E, “A novel fractional order viscoelastic material model for soft biological tissues and its finite element application”, ITEC Tenth Tissue Elasticity Conference, October 12-15, 2011, Arlington, Texas, USA.
2. **Demirci N**, Tonuk E, “Implementation of a fractional order soft tissue material model into MSC Marc 2010 software”, Eksen Engineering MSC Software Users Conference, June 2011, Pendik, Turkey.
1. **Demirci N**, Tonuk E, “Fractional order material model for soft tissues and its finite element implementation”, BIOMATEN Center of Excellence and Biomaterials and Tissue Engineering Conference, May 2011, Middle East Technical University Ankara, Turkey.

Poster Presentations (presenter)

8. **Demirci N**, Kalla O, Maslak R, Holland MA, “Cortical thickness consistently correlates with cortical morphology for both humans and non-humans”. SfN’22: Society for Neuroscience, November 12-16, 2022, San Diego, California, USA.
7. **Demirci N**, Holland MA, “Cortical thickness correlates with cortical morphology”. SfN’21: Society for Neuroscience 50th Annual Meeting, November 8-11, 2021, Virtual Meeting.
6. Wang S, **Demirci N**, Solar VC, Costabal FS, Holland MA, “Unfolding the cortex via a mechanics informed graph neural network”. 17th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering, September 7-9, 2021, Virtual Meeting.

5. Wang S, **Demirci N**, Solar VC, Holland MA, Costabal FS, “In Vivo Quantification of Brain Morphologies Via Mechanics-Informed Deep Learning Approach”. SB³C 2021: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 14-18, 2021, Virtual Meeting.
4. Hoffman ME, **Demirci N**, Holland MA, “The Relation Between Cortical Thickness and Morphology: A Study of Nonhuman Primate Brains”. SB³C 2021: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 14-18, 2021, Virtual Meeting.
3. Holland MA, **Demirci N**, “A local investigation of cortical thickness in relationship to cortical morphology”, Seventh Annual Brain Initiative Investigators Meeting, June 15-17, 2021, Virtual Meeting.
2. Holland MA, **Demirci N**, Wang S, “Mechanics-informed big data analysis of cortical thickness”, Smart and Connected Health (SCH) “Advancing Health Through Science”, Workshop, January 6-7, 2020, National Science Foundation, Alexandria, VA, USA.
1. **Demirci N**, Holland MA, “Local Investigation of the complex morphology of the adult human brain”, Colleges of Science and Engineering Joint Annual Meeting (COSE-JAM), December 13, 2019, University of Notre Dame, IN, USA.

HONORS & AWARDS

- **Diversity Participation Awardee** for SB³C 2023: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 4-8, 2023, Vail, Colorado, USA
- **Center for Research Computing (CRC) Computational Science and Visualization Award Recipient**, 2022, University of Notre Dame, IN, USA.
- **University of Notre Dame Notebaert Professional Development Award Recipient** for SB³C 2022: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 20-23, 2022, Baltimore, Maryland, USA.
- **University of Notre Dame, Graduate Student Government, Conference Presentation Grant** for SfN’21: Society for Neuroscience 50th Annual Meeting, November 8-11, 2021, Virtual Meeting.
- **University of Notre Dame Notebaert Professional Development Award Recipient** for SfN’21: Society for Neuroscience 50th Annual Meeting, November 8-11, 2021, Virtual Meeting.
- **Diversity Participation Awardee** for SB³C 2021: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 14-18, 2021, Virtual Meeting.
- **AME Departmental Travel Award** for Smart and Connected Health (SCH) “Advancing Health Through Science”, Workshop, January 6-7, 2020, National Science Foundation, Alexandria, VA, USA.
- **ERASMUS International Exchange Program Scholarship**, Kaiserslautern University of Technology, 03-08, 2008, Kaiserslautern, Germany.
- **International Baccalaureate (IB) Diploma Recipient**, TED Ankara College, 2002-2004, Ankara, Turkey.

VOLUNTEERING & MENTORSHIP

- **ASME-BED BS-Level Student Paper Competition Judge** at the SB³C 2023: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 4-8, Vail, Colorado, USA.
- **ASME-BED BS and MS-Level Student Paper Competition Judge** at the SB³C 2022: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 20-23, Baltimore, Maryland, USA.
- **The Society of Women Engineers Local Award Judge** at SWE’21: Society of Women Engineers Conference, October 21-23, 2021, Indianapolis, IN, USA.

- **Science Outreach and Communication** at the Brain Awareness Fair, April 15, 2023, South Bend, IN, USA.
- **Undergraduate Student Mentoring** at the University of Notre Dame - CoMMaND Lab
Research Topic: Segmentation of human (fetal, neonatal, and adult) and non-human primate cortices from public magnetic resonance imaging dataset.
Grant Writing: Assisted PI in writing REU Supplement of NSF Grant, 2023.
 2023 - *ongoing*: Reed Snedeker (Aerospace and Mechanical Engineering'25)
 2022 - *ongoing*: Renee Maslak (Physics in Medicine'24)
 2022 - *ongoing*: Lydia Csaszar (Computer Engineering'23)
 2022 - *completed*: Lorcan O'Rourke (Electrical and Electronics Engineering - University College Dublin'23)
 2021 - *ongoing*: Olivia Kalla (Aerospace and Mechanical Engineering'24)
- **Graduate Student Recruitment** for University of Notre Dame at SWE'21: Society of Women Engineers Conference, October 21-23, 2021, Indianapolis, IN, USA.
- **Active Volunteer of the Graduate Guidance Mentorship Program** at the University of Notre Dame.

RESEARCH EXPERIENCE

- 2022-*ongoing*: Investigation of patterns of cortical folding among developing fetal and neonatal human brains from gestation week 27 to 43 using public MRI dataset and application of unsupervised machine learning approaches to classify premature vs. term birth growth and development, University of Notre Dame, IN, USA.
- 2021-2022: Investigation of patterns of cortical folding among adult human and non-human primates using public MRI dataset (https://github.com/mholla/primate_brains) and the development of an open-source MR image segmentation pipeline using Python, University of Notre Dame, IN, USA.

This project focuses on cortical segmentation of non-human primate MR images from public resources, their 3D surface reconstructions, and analysis of cortical folding patterns to explore allometric principles among primates (The full data are available at <https://zenodo.org/record/7574350>).

- 2019-2021: Investigation of patterns of cortical folding among adult human individuals using public MRI dataset and the development of an open-source surface-based neuroimaging pipeline using Python programming (<https://github.com/mholla/curveball>), University of Notre Dame, IN, USA.

This project focuses on calculating quantitative cortical surface measures, such as shape, curvature, cortical thickness, and depth, utilizing differential geometry principles. These measures are automatically calculated and output for each subject through the developed pipeline. Our goal is to obtain accurate and specific diagnostic biomarkers that can distinguish subtle differences between neurotypical and atypical populations.

- 2012-2014: Brief experience in acquiring images using MR elastography technique to determine the viscoelastic properties of a phantom material that mimics soft biological tissues using fractional order material models, University of Illinois at Chicago, Chicago, IL, USA.
- 2009-2012: Development of a fractional-order constitutive material model for biological soft tissues and implementation of the material model into a commercial nonlinear finite element analysis software (MSC Marc) through a user-developed subroutine to characterize nonlinear, viscoelastic,

fractional-order soft biological tissue material model parameters through inverse finite element analysis. Computational FEA modeling of soft biological tissue indentation using various indentation tip geometries, Middle East Technical University, Ankara, Turkey.

- 2009-2012: Upgrading of custom soft biological tissue indentation test set-up with state-of-the-art servo controllers to improve its accuracy in collecting force-deformation data and extracting viscoelastic properties, Middle East Technical University, Ankara, Turkey.
- 2009-2012: Conducting marker-based gait analysis experiments to study knee motion and loading in individuals who have undergone total knee arthroplasty, as well as in healthy controls, Middle East Technical University, Ankara, Turkey.
- 2008-2009: Design and finite element analysis of a dynamic spinal implant for treating lower back pain, Gazi University Senior Design Project, Ankara, Turkey.

TEACHING EXPERIENCE

Teaching Assistantship

- Notre Dame AME 60624: Continuum Mechanics
- Notre Dame AME 40/60572: Introduction to Biomechanics
- Notre Dame AME 30363: Design of Machine Elements
- Notre Dame AME 20241: Solid Mechanics
- UIC BIOE 101: Introduction to Bioengineering
- UIC BIOE 396: Senior Design II
- Metu ME 200: Mechanical Engineering Orientation-Biomechanics Group
- Metu ME 205: Statics
- Metu ME 206: Strength of Materials
- Metu ME 210: Applied Mathematics for Mechanical Engineers
- Metu ME 301: Theory of Machines - I
- Metu ME 303: Manufacturing Engineering
- Metu ME 310: Numerical Methods
- Metu ME 410: Mechanical Engineering Systems Laboratory
- Metu ME 413: Introduction to Finite Element Analysis

Certificates

- **Striving for Excellence in Teaching**, May 2023, Kaneb Center, University of Notre Dame, IN, USA.
- **Collaborative Teaching and Learning Certificate**, May 2021, Kaneb Center, University of Notre Dame, IN, USA.

INDUSTRY EXPERIENCE

Principal Mechanical Design Engineer
Roketsan A.S, Ankara, TURKEY

2015-2019

Main Responsibilities

- 3-D mechanical design of air-to-air, air-to-ground missile launcher systems and sub-systems using CATIA V6/PLM and development of the technical data package.
- Development and management of families of models for all mechanical, electrical, wire harness components, packaging assemblies, and mounting fixtures.

- Implementation of design-for-manufacturability (DFM) mindset for composite materials
- Sharing of the technical part and assembly drawings with sub-contractors for manufacturing the prototype and management of drawing revisions.

Secondary Responsibilities

- Mechanical, thermal, and modal finite element analysis of state-of-the-art mechanical designs using ANSYS 18.
- Verification and validation of prototypes according to MIL-810-G mechanical, electrical, and environmental testing standards.
- Management of project timeline from start to finish including customer delivery.

Mentorship

Volunteered as a company mentor for Bilkent University mechanical engineering senior students and assigned their final projects for three consecutive years:

- 2016-2017: *Design and manufacturing of an autonomous military robot with predetermined payload.*
- 2017-2018: *Retractable launcher system for an all-terrain military mobile combat vehicle.*
- 2018-2019: *Unmanned aerial vehicle (UAV) pneumatic launcher system.*

Training

- Computer aided design using CATIA V6 PLM, 2015, Roketsan A.S, Ankara, Turkey.
- Structural, thermal, and modal analysis using ANSYS 18, 2017, Figes Engineering, Ankara, Turkey.
- MIL-STD-810G: Understanding, Planning and Performing Climatic and Dynamic Testing, 2018, Equipment Reliability Institute, Fullerton, CA, USA.

COMPUTER SKILLS

Programs

- ANSYS 18, Autocad, CATIA V5, Catia V6 PLM, Mathematica, MATLAB r2019, MSC MARC, Solidworks, Neuroimaging Software (Freesurfer, AFNI, FSL, ANTs, SPM)

Languages

- Fortran 77/95, LaTeX, Python 3, MATLAB, R, Visual Basic