

# NAGEHAN DEMIRCI

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## EDUCATION

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

## PUBLICATIONS

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### *Peer-Reviewed*

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*, (in press), 2022.
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

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### *Conference Presentations*

8. **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
7. **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
6. **Demirci N**, Holland MA, “Cortical thickness correlates with cortical morphology among human and non-human primate brains”. SB3C2021: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 20-23, 2022, Baltimore, Maryland, USA
5. **Demirci N**, Holland MA, “Cortical thickness distribution of the human cerebral cortex identified by curvature at local scales”. SB3C2021: 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”. SB3C2020: 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*

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’21: 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’21: 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
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

## HONORS & AWARDS

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- o **Center for Research Computing (CRC) Computational Science and Visualization Award Recipient**, University of Notre Dame, 2022
- o **University of Notre Dame Notebaert Professional Development Award Recipient** for SB3C’22: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 20-23, 2022, Baltimore, Maryland
- o **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
- o **University of Notre Dame Notebaert Professional Development Award Recipient** for SfN’21: Society for Neuroscience 50th Annual Meeting, November 8-11, 2021, Virtual Meeting
- o **SB3C Diversity Participation Awardee** for SB3C’21: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 14-18, 2021, Virtual Meeting
- o **AME Departmental Travel Award** for Smart and Connected Health (SCH) “Advancing Health Through Science”, Workshop, January 6-7, 2020, National Science Foundation, Alexandria, VA
- o **ERASMUS Scholarship for International Exchange Program**, Kaiserslautern University of Technology, 03-08, 2008, Kaiserslautern, GERMANY
- o **International Baccalaureate (IB) Diploma Recipient**, TED Ankara College, 2002-2004, Ankara, TURKEY

## VOLUNTEERING & MENTORSHIP

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- o **ASME-BED BS and MS-Level Student Paper Competition Judge** at the SB3C’22: Summer Biomechanics, Bioengineering, and Biotransport Conference, June 20-23, Baltimore, Maryland
- o **Undergraduate Research Advising** at the University of Notre Dame - CoMMaND Lab  
 Research Topic: *Segmentation of three tissue classes of non-human primate cortices*  
 2021 - *ongoing*: Olivia Kalla (AME’24)  
 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)
- o **Graduate Student Recruitment** for University of Notre Dame at SWE’21: Society of Women Engineers Conference, October 21-23, 2021, Indianapolis, IN
- o **Judge for 2022 WE Local Awards** at SWE’21: Society of Women Engineers Conference, October 21-23, 2021, Indianapolis, IN
- o **Active Mentor at the Graduate Guidance Mentorship Program** at the University of Notre Dame

## RESEARCH

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## **Experience**

- Morphological investigation and scaling of several non-human primate cerebral cortices through magnetic resonance images [https://github.com/mholla/primate\\_brains](https://github.com/mholla/primate_brains) with a focus on curvature, cortical thickness, depth, and gyrification in an overarching goal of elucidating similarities and differences, 2019-ongoing, University of Notre Dame, IN
- Morphological investigation of the human cerebral cortex: Development of an open-source computational toolbox <https://github.com/mholla/curveball> to calculate and analyze the quantitative cortical surface measures such as curvature, cortical thickness, and depth in an overarching goal of obtaining accurate and reproducible diagnostic biomarkers that can identify subtle differences between neurotypical and atypical populations, 2019-ongoing, University of Notre Dame, IN
- Biological soft tissue constitutive material model formulation using fractional calculus and implementation into finite element software via user-developed subroutine and computational nonlinear finite element simulations of soft biological tissues, 2009-2012, Middle East Technical University, Ankara, Turkey
- Experimental gait analysis on healthy individuals and individuals post-surgery, 2009-2012, Middle East Technical University, Ankara, Turkey

## **Projects**

- Upgrading soft biological tissue indentation test set-up, 2010-2012, Middle East Technical University, Ankara, TURKEY.
- Design and production of a 3 point bending test apparatus for Turkish State Railways, 2011, Middle East Technical University, Ankara, TURKEY.
- Mechanical design and finite element analysis of a dynamic spinal implant, 2009, Gazi University, Ankara, TURKEY.

## **TEACHING**

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### **Teaching Assistant**

- 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**

- **Collaborative Teaching and Learning Certificate**, May 2021, Kaneb Center, University of Notre Dame, IN

## **INDUSTRY EXPERIENCE**

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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 of the first prototype and management of drawing revisions.

### **Secondary Responsibilities**

- Optimization of the mechanical, thermal, and modal properties of state-of-the-art designs by finite element analysis using ANSYS 18.
- Verification of the prototype according to MIL-810-G mechanical, electrical, and environmental testing standards.
- Project time-line management for customer delivery.

### **Mentorship**

Provided research ideas and volunteered as a company mentor to Bilkent University senior design projects in the mechanical engineering department for three consecutive years

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

### **Training**

- Mechanical design with CATIA V6 PLM, 2015, Roketsan A.S, Ankara, TURKEY.
- Structural, thermal, modal, and fatigue analysis with 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**

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### **Programs**

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

### **Languages**

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