

# Zeki O. Ilhan, PhD

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## EDUCATION

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### **Lehigh University, Bethlehem, PA**

**Ph.D. in Mechanical Engineering – Control Systems**

*Sep 2016*

Advisor: Dr. Eugenio Schuster

Dissertation:

*Model-based Optimization and Feedback Control of the Current Density Profile Evolution in NSTX-U*

### **Middle East Technical University (METU), Ankara, Turkey**

**B.S. in Mechanical Engineering**

*Jun 2010*

## ACADEMIC EXPERIENCE

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### **Midwestern State University, Wichita Falls, TX**

Associate Professor

*Aug 2023 – Present*

Assistant Professor

*Aug 2018 – Aug 2023*

Visiting Assistant Professor

*Aug 2017 – Aug 2018*

### **US Coast Guard Academy, New London, CT**

Mechanical Engineering Lecturer

*Jan 2017 – Jun 2017*

### **Princeton Plasma Physics Laboratory, Princeton, NJ**

Visiting Researcher

*Jun 2015 – Aug 2015*

## TEACHING EXPERIENCE

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### **Midwestern State University, Wichita Falls, TX**

MENG 1101 - Introduction to Engineering

*Mean Instructor Rating = 4.64 / 5.00*

MENG 1132 - Engineering Graphics

*4.57 / 5.00*

MENG 1202 - Solid Modeling

*4.66 / 5.00*

MENG 2113 - Statics

*4.50 / 5.00*

MENG 2212 - Engineering Computation

*4.75 / 5.00*

MENG 2223 - Mechanics of Solids

*4.71 / 5.00*

MENG 4122 - Machine Control Programming Laboratory

*4.43 / 5.00*

MENG 4143 - Senior Design Laboratory I

*4.24 / 5.00*

MENG 4243 - Senior Design Laboratory II

*3.82 / 5.00*

MENG 4203 - Mechanical Engineering Analysis

*4.58 / 5.00*

MENG 4253 - Control Systems

*4.61 / 5.00*

## TEACHING EXPERIENCE (CONT'D)

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*US Coast Guard Academy, New London, CT*

*Jan 2017 – Jun 2017*

Modeling and Control of Dynamic Systems

Engineering Materials Science Laboratory

*Lehigh University, Bethlehem, PA*

*Jan 2013 – Jun 2013*

Mechanical Vibrations (Recitation Leader)

Mechanical Engineering Laboratory I (Teaching Assistant)

## RELEVANT SKILLS

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- **PLC Programming:** RSLogix 500, RSLogix 5000
- **PLC HMI Development:** PanelBuilder32, FactoryTalk View Studio
- **PLC Hardware:** Allen Bradley SLC 5/05, Allen Bradley CompactLogix
- **Computing/Simulation:** MATLAB, SIMULINK
- **IDE Programming:** ARDUINO
- **Computer-Aided Design:** SolidWorks
- **3D-Printing/Slicing:** UltiMaker Cura, Slic3r
- **Typesetting:** LaTeX

## JOURNAL PUBLICATIONS

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1. W. Guttenfelder, (**Z. Ilhan**) et al. (Collaboration Paper), "NSTX-U theory, modeling and analysis results" *Nuclear Fusion* 62 (2022) 042023 (17 pp).  
<https://iopscience.iop.org/article/10.1088/1741-4326/ac5448>
2. **Z. Ilhan**, Mark D. Boyer, and E. Schuster, "TRANSP-based closed-loop simulations of current profile optimal regulation in NSTX-Upgrade" *Fusion Engineering and Design*, vol. 146, part A, pp. 555-558, February 2019.  
<https://doi.org/10.1016/j.fusengdes.2019.01.021>
3. **Z. Ilhan**, J.E. Barton, E. Schuster, D.A. Gates, S.P. Gerhardt, and J.E., Menard, "Physics-based control-oriented modeling of the current density profile evolution in NSTX-Upgrade" *Fusion Engineering and Design*, vol. 123, pp. 564-568, November 2017.  
<https://doi.org/10.1016/j.fusengdes.2017.04.028>
4. **Z. Ilhan**, Q. Wang, J. Barry, D. Huxley-Cohen, H. Wang, E. Schuster et al, "Extremum-seeking-based fluctuation mitigation and azimuthal velocity profile regulation by  $E \times B$  Actuation in HELCAT" *IEEE Transactions on Plasma Science*, vol. 42, no. 3, pp. 458-468, March 2014.  
<https://ieeexplore.ieee.org/document/6737330>
5. **Z. Ilhan**, D. Huxley-Cohen, H. Wang, E. Schuster, M Gilmore, and A. Ware, "Optimal control of the plasma azimuthal velocity profile by feedback ExB actuation in HELCAT" *IEEE Transactions on Plasma Science*, vol. 42, no. 3, pp. 469-476, March 2014.  
<https://ieeexplore.ieee.org/document/6750102>

1. **Z. Ilhan**, "Nonlinear Robust Control Design for a Planar Robot Arm." *Proceedings of the 2024 International Federation for the Promotion of Mechanism and Machine Science (IFTToMM) Young Faculty Group Symposium on Emerging Fields in Mechanism and Machine Science (YFG-MMS)*. Online. November 19-21, 2024.  
<https://doi.org/10.17185/dupublico/82637>
2. **Z. Ilhan**, "Benchmarking Various Nonlinear Control Design Techniques for a Two-Link Planar Robot Arm." *Proceedings of the ASME 2022 International Mechanical Engineering Congress and Exposition (IMECE) Volume 7: Engineering Education*. Columbus, Ohio, USA. October 30–November 3, 2022.  
V007T09A004. ASME.  
<https://doi.org/10.1115/IMECE2022-95524>
3. **Z. Ilhan**, & M. Chew, "Nonlinear Robust Control Design for a Gravity Compensation Mechanism under Human Walking Pattern Scenarios." *Proceedings of the ASME 2021 International Mechanical Engineering Congress and Exposition. Volume 7A: Dynamics, Vibration, and Control*. Virtual, Online. November 1–5, 2021.  
V07AT07A026. ASME.  
<https://doi.org/10.1115/IMECE2021-71712>
4. **Z. Ilhan**, "Design of Model-Based Linear and Nonlinear Controllers to Stabilize a Simple Experimental Setup for Controls Education." *Proceedings of the ASME 2021 International Mechanical Engineering Congress and Exposition. Volume 9: Engineering Education*. Virtual, Online. November 1–5, 2021.  
V009T09A004. ASME  
<https://doi.org/10.1115/IMECE2021-71863>
5. **Z. Ilhan**, & M. Chew, "Nonlinear Control Design for a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation." *Proceedings of the ASME 2020 International Mechanical Engineering Congress and Exposition. Volume 7A: Dynamics, Vibration, and Control*. Virtual, Online. November 16–19, 2020.  
V07AT07A020. ASME.  
<https://doi.org/10.1115/IMECE2020-24148>
6. **Z. Ilhan**, J.T. Ok, B. Eakins, C. Masters, K. Thompson, and T. Vital, "Design and Implementation of a Pulley-Based Movable LED System for Optimal Plant Growth." *Proceedings of the ASME 2020 International Mechanical Engineering Congress and Exposition. Volume 5: Biomedical and Biotechnology*. Virtual, Online. November 16–19, 2020.  
V005T05A020. ASME.  
<https://doi.org/10.1115/IMECE2020-24089>
7. **Z. Ilhan**, W. Loveland, and J. Baker, "Design of a Simple Experimental Setup for Proportional-Integral-Derivative (PID) Control Testing." *Proceedings of the ASME 2020 International Mechanical Engineering Congress and Exposition. Volume 9: Engineering Education*. Virtual, Online. November 16–19, 2020.  
V009T09A007. ASME.  
<https://doi.org/10.1115/IMECE2020-24204>
8. **Z. Ilhan**, W.P. Wehner, and E. Schuster, "Model Predictive Control with Integral Action for the Rotational Transform Profile Tracking in NSTX-U" *Proceedings of the IEEE Conference on Control Applications*, (Buenos Aires, Argentina), 2016, pp. 623-628.  
<https://ieeexplore.ieee.org/document/7587899>

9. **Z. Ilhan**, W. Wehner, J. Barton, E. Schuster et al, "First-Principles-Driven Model-Based Optimal Control of the Current Profile in NSTX-U"  
*Proceedings of the IEEE Conference on Control Applications*, (Sydney, Australia), 2015, pp. 1303-1308.  
<https://ieeexplore.ieee.org/document/7320792>
10. **Z. Ilhan**, D. Huxley-Cohen, H. Wang, E. Schuster et al, "Optimal Closed-Loop Control of the Azimuthal Velocity Profile by E×B Actuation in HELCAT", *IEEE 25<sup>th</sup> Symposium on Fusion Engineering (SOFE)*, San Francisco, California, USA, June 10-14, 2013.  
<https://ieeexplore.ieee.org/document/6635480>
11. **Z. Ilhan** J. Barry, H. Wang, E. Schuster, M. Gilmore, and A. Ware, "Fluctuation Mitigation and Azimuthal Velocity Profile Regulation by Extremum Seeking in HELCAT", *IEEE 25<sup>th</sup> Symposium on Fusion Engineering (SOFE)*, San Francisco, California, USA, June 10-14, 2013.  
<https://ieeexplore.ieee.org/document/6635479>

## CONFERENCE ABSTRACTS & POSTER PRESENTATIONS

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1. S. Azzouz, J. Brink, R. Desai, M. Elsharafi, Y. Guo, **Z. Ilhan**, P. Pokharel, and S. Wang. "Young Engineers Summer Camp for K-12 Students: STEM Experiences and Lessons Learned", *2023 ASME International Mechanical Engineering Congress and Exposition (IMECE)*, IMECE 2023-109837, New Orleans, LA, USA. October 29 – November 2, 2023.
2. **Z. Ilhan**, S. Lee, P. Nguyen, and M. White, "Mechanism-Control Design Integration for a Gravity Compensation System for Human Lower Limb Rehabilitation", *2023 Oklahoma State University (OSU) International Mechatronics Conference and Exposition*. Oklahoma City, OK, USA, September 27 - 29, 2023.
3. **Z. Ilhan**, N. Inge, G. Junkere, T. Green, and C. Simeon, "Design and Control of a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", *2021 Oklahoma State University (OSU) International Mechatronics Conference and Exposition*, Virtual, Online. September 27 - October 1, 2021.
4. R. Stuart, J. Gillis, T. Hardee, C. Park, C. Palmore, **Z. Ilhan**, B. Schaffner, and J. Arbuckle, "Design of a Rotating Assembly Fixture for Power Take-Off Units", *2020 ASME International Mechanical Engineering Congress and Exposition (IMECE)*, IMECE 2020-24089, Virtual, Online. November 16-19, 2020.
5. **Z. Ilhan**, W. Loveland, and J. Baker, "Design of a Simple Experimental Setup for Linear and Nonlinear Control Testing", *2020 Oklahoma State University (OSU) International Mechatronics Conference and Exposition*, Virtual, Online. October 20-22, 2020.
6. C. LaRonde and **Z. Ilhan**, "Adaptive Control Design for a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", *Capital of Texas Undergraduate Research Conference*, University of Texas at Austin, Austin, TX, November 16, 2019.
7. J. Cognasi, J. Perkins, J. Randall, M. Ronoh, J.T. Ok, and **Z. Ilhan**, "A Pulley Based Movable LED System for Plant Growth", *2019 ASME International Mechanical Engineering Congress and Exposition (IMECE)*, IMECE 2019- 11602, Salt Lake City, UT, November 11-14, 2019.
8. **Z. Ilhan**, E. Schuster, M.D. Boyer, "TRANSP-based Closed-loop Simulations of Current Profile Optimal Regulation in NSTX-Upgrade", *30th Symposium on Fusion Technology (SOFT)*, Giardini Naxos, Sicily, Italy, September 16-21, 2018.

## CONFERENCE ABSTRACTS & POSTER PRESENTATIONS (CONT'D)

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9. **Z. Ilhan**, W.P. Wehner, E. Schuster and D. Boyer, "Model Predictive Control with Integral Action for Current Density Profile Tracking in NSTX-U", *58th Division of Plasma Physics (DPP) Annual Meeting of the American Physical Society (APS)*, San Jose, California, USA, October 31-November 4, 2016.
10. **Z. Ilhan**, W.P. Wehner, E. Schuster, M.D. Boyer, D.A. Gates et al, "Performance Assessment of Model-Based Optimal Feedforward and Feedback Current Profile Control in NSTX-U Using the TRANSP Code", *57th Division of Plasma Physics (DPP) Annual Meeting of the American Physical Society (APS)*, Savannah, Georgia, USA, November 16-20, 2015.
11. **Z. Ilhan**, J. Barton, W. Wehner et al, "First-Principles-Driven Model-Based Optimal Control of the Current Profile in NSTX-U", *56th Division of Plasma Physics (DPP) Annual Meeting of the American Physical Society (APS)*, New Orleans, Louisiana, USA, October 27-31, 2014.
12. **Z. Ilhan**, J. Barton, W. Shi et al, "Physics-Based Control-Oriented Modeling of the Current Profile Evolution in NSTX-Upgrade", *55th Division of Plasma Physics (DPP) Annual Meeting of the American Physical Society (APS)*, Denver, Colorado, USA, November 11-15, 2013.
13. **Z. Ilhan**, D. Huxley-Cohen, H. Wang, E. Schuster *et al*, "Optimal Closed-Loop Control of the Azimuthal Velocity Profile by E×B Actuation in HELCAT", *IEEE 25<sup>th</sup> Symposium on Fusion Engineering (SOFE)*, San Francisco, California, USA, June 10-14, 2013.
14. **Z. Ilhan**, J. Barry, H. Wang, E. Schuster, M. Gilmore, and A. Ware, "Fluctuation Mitigation and Azimuthal Velocity Profile Regulation by Extremum Seeking in HELCAT", *IEEE 25<sup>th</sup> Symposium on Fusion Engineering (SOFE)*, San Francisco, California, USA, June 10-14, 2013.
15. **Z. Ilhan**, D. Huxley-Cohen, J. Barry et al, "Optimal Closed-Loop Control of the Azimuthal Velocity Profile in HELCAT by E×B Actuation", *54th Division of Plasma Physics (DPP) Annual Meeting of the American Physical Society (APS)*, Providence, Rhode Island, USA, October 29-November 2, 2012.
16. **Z. Ilhan**, E. Schuster, S. Xie, M. Gilmore, and A. Ware, "Optimal Azimuthal Velocity Profile Control by E×B Actuation in HELCAT", *53rd Division of Plasma Physics (DPP) Annual Meeting of the American Physical Society (APS)*, Salt Lake City, Utah, USA, November 14-18, 2011.

## GRANTS & SPONSORED RESEARCH

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1. **Z. Ilhan (PI)**, P. Pokharel (co-PI), M. Elsharafi (co-PI), *Howmet Aerospace Foundation*: "Young Engineer Summer (YES) Camp", June 23-27 2025, \$20,000.00 (acquired).
2. **Z. Ilhan (PI)**, P. Pokharel (co-PI), M. Elsharafi (co-PI), *Howmet Aerospace Foundation*: "Young Engineer Summer (YES) Camp", June 24-28 2024, \$20,000.00 (acquired).
3. **Z. Ilhan (PI)**, P. Pokharel (co-PI), M. Elsharafi (co-PI), *Howmet Aerospace Foundation*: "Young Engineer Summer (YES) Camp", June 26-30 2023, \$20,000.00 (acquired).
4. S. Azzouz (PI), **Z. Ilhan (co-PI)**, P. Pokharel (co-PI), *Howmet Aerospace Foundation*: "Young Engineer Summer (YES) Camp", June 20-24 2022, \$20,000.00 (acquired).
5. S. Azzouz (PI), **Z. Ilhan (co-PI)**, P. Pokharel (co-PI), *Howmet Aerospace Foundation*: "Young Engineer Summer (YES) Camp", June 21-25 2021, \$20,000.00 (acquired).
6. **Z. Ilhan (PI)**, *MSU Texas Intramural Grant*: "Nonlinear, Sliding-Mode Control of a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", 2019-2021, \$3,902.24 (acquired).

## UNDERGRADUATE RESEARCH & SENIOR DESIGN PROJECTS ADVISED

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1. A. Childs, M. Denefield, S. McDaniel, and **Z. Ilhan**, "Design, Fabrication, and Control of a Planar Robotic Manipulator", *Senior Design*, Fall 2024 & Spring 2025.
2. B. Birkenfeld, A. Seward, S. Van Noy, and **Z. Ilhan**, "Mechanism-Control Design Integration for a Gravity Compensation System for Human Lower-Limb Rehabilitation", *Senior Design*, Fall 2023 & Spring 2024.
3. S. Lee, P. Nguyen, M. White, and **Z. Ilhan**, "Design and Control of a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", *Senior Design*, Fall 2022 & Spring 2023.
4. B. Westwick, W. Loveland, and **Z. Ilhan**, "Design and Control of a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", *Senior Design*, Fall 2021 & Spring 2022.
5. N. Warner, B. Vidal, **Z. Ilhan**, "Analysis of Heat Transfer in a Disc Brake System", *MSU Texas Undergraduate Research Opportunities and Summer Workshop (UGROW)*, 2021.
6. S. Edwards and **Z. Ilhan**, "Photogrammetry-Based 3D Printing: Applications in Engineering and Beyond", *Undergraduate Research and Creative Activities (EURECA)*, Spring 2021.
7. T. Green, N. Inge, G. Junkere, C. Simeon, and **Z. Ilhan**, "Design and Control of a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", *Senior Design*, Fall 2020 & Spring 2021.
8. J. Baker and **Z. Ilhan**, "Design and Implementation of Linear and Nonlinear Controllers to Stabilize an Experimental Test Setup", *Undergraduate Research and Creative Activities (EURECA)*, Spring 2020.
9. R. Stuart, J. Gillis, T. Hardee, C. Park, C. Palmore, **Z. Ilhan**, B. Schaffner, and J. Arbuckle, "Design of a Rotating Assembly Fixture for Power Take-Off Units", *Senior Design*, Fall 2019 & Spring 2020.
10. J. Cognasi, J. Perkins, J. Randall, M. Ronoh, J.T. Ok, and **Z. Ilhan**, "Automated Grow Light System for Biological Research", *Senior Design*, Fall 2019 & Spring 2020.
11. W. Loveland and **Z. Ilhan**, "Design of an Experimental Setup for Proportional-Integral-Derivative (PID) Control Tuning", *Undergraduate Research and Creative Activities (EURECA)*, Fall 2019.
12. C. LaRonde and **Z. Ilhan**, "Adaptive Control Design for a Gravity Compensation Mechanism for Human Lower Limb Rehabilitation", *Undergraduate Research Opportunities and Summer Workshop (UGROW)*, 2019.

## INDUSTRY CONSULTATIONS

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### *WPT Power Corporation, Wichita Falls, TX*

- Design of a Rotating Fixture for Power Take-Off (PTO) Units *Aug 2019 – May 2020*
- Modeling and Calculation of the Hydraulic Pressure Force in a Clutch *Dec 2019*

## AWARDS & HONORS

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### *Midwestern State University, Wichita Falls, TX*

- Professor of the Year Award – McCoy School of Engineering *Apr 2024*
- Professor of the Year Award – McCoy School of Engineering *Apr 2018*

### *Lehigh University, Bethlehem, PA*

- Rossin Doctoral Fellowship Award *Aug 2010*

## SERVICE TO DEPARTMENT

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### Director: "Young Engineer Summer (YES) Camps"

*Jun 2023 - present*

- Coordinating the grant application and assessment processes.
- Overseeing the member selection and camp organization.
- Organizing engineering workshops for local middle-high school students.

### Member: "ABET Criterion 5 Committee"

*Mar 2020 – July 2020*

- Drafted the sub-section on "Broad Education Component".
- Prepared the ABET-compatible syllabus templates.

### Student Recruitment Events:

*Mar 2019 – Present*

- Wichita Falls ISD Events
- MSU Texas Football
- MSU Texas Mustang Rallies

## SERVICE TO UNIVERSITY

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### Advisory Committee Member: "First-Year Mustangs Adventure"

*Aug 2022 – Present*

- Purpose: Prepare new students for academic success and engagement to improve retention.
- Assisting with the curriculum development and assessment of the new freshman seminar class.
- Serving as a faculty mentor of the new freshman seminar class.

### Reviewer/Evaluator: "Undergraduate Research (EURECA) Program"

*Aug 2018 – Present*

- Reviewed numerous faculty research proposals.
- Evaluated numerous presentations in the University Research Forums.
- Served as a Moderator/Evaluator in the University Research Forums.

## SERVICE TO PROFESSION

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### Topic Chair/Co-chair: "ASME IMECE Conference, Engineering Education Track"

- Topic Co-Chair: "Mechatronics, Robotics, Automation, Control Engineering" *Nov, 2024*
- Topic Co-Chair: "Distance/Online Engineering Education" *Nov, 2024*
- Topic Chair: "Mechatronics, Automation, Robotics, and Control Engineering" *Oct, 2023*
- Topic Co-chair: "Distance/Online Engineering Education" *Oct, 2023*
- Topic Co-chair: "Distance/Online Engineering Education" *Nov, 2022*
- Topic Co-chair: "Applied Mechanics, Dynamic Systems and Control Engineering" *Nov, 2022*
- Topic Co-chair: "Teaching Laboratories and Technology-Aided Lecturing" *Nov, 2022*

### Session Chair: "Oklahoma State University Mechatronics Conferences"

- Technical Session Chair: "Smart Adaptive Structures" *Sep, 2023*
- Technical Session Chair: "Robotics in Healthcare" *Oct, 2021*
- Poster Session Chair: "Mechatronics in Education" *Oct, 2020*

## SERVICE TO COMMUNITY

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### Tutor/Guest Lecturer:

- Boys Scouts of America - Engineering Merit Badge *Mar 2021 – Present*
- River Bend Nature Center *Oct, 2019*

### Judge/Evaluator:

- TAME Annual STEM Competitions *Feb 2021 – Present*
- TCEA Area 9 Robotics Competitions *Jan 2019 – Jan 2023*
- FIRST Tech Challenge Robotics Competition Vernon, TX *Nov 2021 – Nov 2022*

## EXTRACURRICULAR ACTIVITIES

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### Flute Player & Member:

- MSU Texas Communiversy Instrumental Ensemble *Jan 2025 – Present*
- MSU Texas Orchestra & Wind Ensemble *Aug 2017 – May 2019*
- Lehigh University Philharmonic Orchestra & Wind Ensemble *Aug 2010 – May 2016*
- Municipal Band of Bethlehem, PA *May 2015 – Aug 2016*
- Kappa Kappa Psi – National Honorary Band Fraternity *May 2011 – Aug 2016*