

# Melih Can Yesilli

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## EDUCATION

**Michigan State University**, East Lansing, MI

August 2018 – present

*PhD Candidate, Department of Mechanical Engineering*

GPA: 3.81/4.0

Thesis Title: Machine Learning Applications on Complex Dynamical Systems Using Topological Data Analysis

Advisor: Dr. Firas Khasawneh

**Middle East Technical University**, Ankara, Turkey

September 2013 – June 2018

*Bachelor of Science, Department of Mechanical Engineering*

GPA: 3.47/4.0

## WORK EXPERIENCE

**Michigan State University**

East Lansing, MI

*Graduate Research Assistant*

August 2018 – present

### **Chatter Detection in Machining Using Machine Learning**

- Developed an approach that can classify unstable and stable time series with 96% accuracy using Topological Data Analysis and machine learning
- Developed the machine learning module of Python package named teaspoon
- Diagnosed chatter in machining signals with 98% accuracy using similarity measures of time series and K-Nearest Neighbor algorithm
- Achieved 95% accuracy using transfer learning approach for detecting unstable machining signals

### **Surface Texture Analysis Using Machine Learning**

- Reduced the time needed to compute surface modes by 99.6% by developing an automatic threshold selection algorithm for Discrete Cosine Transform
- Obtained 95% classification accuracy for surface texture classification using information theory and image processing
- Classified surface images with 96% accuracy using Topological Data Analysis

### **Tool Wear Identification**

- Collaborated with Laboratory of Advanced Manufacturing Processes in Michigan State University to perform titanium cutting experiments
- Synchronized two data acquisition boxes to collect data from a microphone, force dynamometer, and acoustic emission sensor at different sampling rates
- Analyzing experimental data to extract useful information to detect and predict tool fracture

### **Roketsan**

Ankara, Turkey

*Engineering Trainee*

November 2017 – April 2018

- Focused on navigation of aerial vehicles and Inertial Measurement Units (IMU)
- Developed Kalman Filter based Attitude and Heading Reference System

*Intern*

June 2017 – July 2017

- Designed complimentary filter based Attitude and Heading Reference System
- Conducted experiments using gyroscope and accelerometer

### **TEI - TUSAS Engine Industries**

Eskisehir, Turkey

*Intern*

July 2016 – August 2016

- Conducted cost analysis for two aircraft parts named as front rotating air seal and spool of a jet engine
- Inspected manufacturing processes applied in the factory such as milling, turning, shot peening, welding, deburring, and heat treatment

## TEACHING EXPERIENCE

**Michigan State University**

East Lansing, MI

*Graduate Teaching Assistant*

January 2019 – present

- ME451L - Control Systems Laboratory (Spring 2019, Spring 2020, Spring 2022)
  - Supervised laboratory sessions and graded students' assignments
- ME461 - Mechanical Vibrations (Fall 2020)
  - Graded students' assignments and assisted with teaching materials
- ME422 - Introduction to Combustion - (Fall 2019)
  - Graded students' assignments
- ME416 - Computer Assisted Design of Thermal Systems - (Fall 2019)
  - Graded students' assignments

## **PUBLICATIONS**

### **Journal Papers**

- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, “Chatter Detection in Turning Using Machine Learning and Similarity Measures of Time Series via Dynamic Time Warping,” *Journal of Manufacturing Processes*, 2022. <https://doi.org/10.1016/j.jmapro.2022.03.009>
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, “Topological feature vectors for chatter detection in turning processes” *The International Journal of Advanced Manufacturing Technology*, 2022. <https://doi.org/10.1007/s00170-021-08242-5>
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, “On transfer learning for chatter detection in turning using wavelet packet transform and ensemble empirical mode decomposition,” *CIRP Journal of Manufacturing Science and Technology*, 2019, <https://doi.org/10.1016/j.cirpj.2019.11.003>

### **Preprints**

- **M. C. Yesilli**, J. Chen, F. A. Khasawneh and Y. Guo, “Automated Surface Texture Analysis via Discrete Cosine Transform and Discrete Wavelet Transform,” 2021. (*Under Review*)
- A. Myers, **M. C. Yesilli**, F. A. Khasawneh, “On Time Series Methods for Chaos Detection: Application to Large Scale Double Pendulum Simulation,” 2021 (*Under Review*)
- **M. C. Yesilli**, F. A. Khasawneh, B. P. Mann, “Transfer Learning for Autonomous Chatter Detection in Machining,” 2021. (*Under review*)

### **Conference Papers**

- **M. C. Yesilli**, M. Chumley, J. Chen, F. A. Khasawneh and Y. Guo, “Exploring Surface Texture Quantification in Piezo Vibration Striking Treatment (PVST) Using Topological Measures”, MSEC2022. (*Under Review*)
- **M. C. Yesilli** and F. A. Khasawneh “Data-driven and Automatic Surface Texture Analysis Using Persistent Homology,” In 2021 *20th IEEE International Conference on Machine Learning and Applications*, IEEE, <https://doi.org/10.1109/ICMLA52953.2021.00219>
- **M.C., Yesilli**, F. A. Khasawneh, “Data-driven Model Identification for a Chaotic Pendulum with Variable Interaction Potential”. IDETC 2020, <https://doi.org/10.1115/DETC2020-22597>
- **M. C. Yesilli**, F. A. Khasawneh, “On Transfer Learning of Traditional Frequency and Time Domain Features In Turning,” *15th International Manufacturing Science and Engineering Conference*, MSEC 2020. <https://doi.org/10.1115/MSEC2020-8274>
- **M. C. Yesilli**, S. Tymochko, F. A. Khasawneh, E. Munch, “Chatter Diagnosis in Milling Using Supervised Learning and Topological Features Vector,” In 2019 *18th IEEE International Conference on Machine Learning and Applications*, IEEE, <https://doi.org/10.1109/ICMLA.2019.00200>
- J. R. Tempelman, A. Myers, **M. C. Yesilli**, “Experimental Investigations Into Broadband Vibration of Metastructures with Lattice Designs,” In *Proceedings of the ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, IDETC2019, <https://doi.org/10.1115/DETC2019-97673>

## **PRESENTED WORK**

### **Contributed Talks**

- **Data-driven and Automatic Surface Texture Analysis Using Persistent Homology**, ICMLA 2021, December 2021
- **Chatter Detection in Turning Using Dynamic Time Warping and Approximate and Eliminate Search Algorithm**, SIAM Conference on Applications of Dynamical Systems, May 2021
- **On Transfer Learning of Traditional Frequency and Time Domain Features In Turning**, MSEC2020 (Virtual Conference), September 2020
- **Data-driven Model Identification for a Chaotic Pendulum with Variable Interaction Potential**, IDETC/MSNDC (Virtual Conference), August 2020
- **Chatter Classification and Transfer Learning in Turning Using Topological Data Analysis and Dynamic Time Warping**, MSU TDA Seminar, April 2020
- **Topological Feature Vectors for Chatter Detection in Turning Processes**, The 1st Midwest Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning, June 2019
- **Topological Feature Vectors for Chatter Detection in Turning Processes**, SIAM Conference on Applications of Dynamical Systems, May 2019
- **Chatter diagnosis in turning using Topological Data Analysis**, SIAM Great Lakes Section Meeting, April 2019

### **Poster**

- A.D. Myers, **M.C. Yesilli**, S. Tymochko, F. Khasawneh and E. Munch, “Teaspoon: A comprehensive python package for topological signal processing.” *Topological Data Analysis and Beyond Workshop at NeurIPS 2020*.

## **CODE AND DATA REPOSITORIES**

- A. Myers, **M. C. Yesilli**, S. Tymochko, F. A. Khasawneh and E. Munch, (2020), Teaspoon: A Topological Signal Processing Package, `pypi/teaspoon`.

- N. Mork, **M. C. Yesilli**, F. A. Khasawneh, (2020). Design of chaotic pendulum with a variable interaction potential, Zenodo, DOI: 10.5281/zenodo.3784897
- F. A. Khasawneh, A. Otto and **M. C. Yesilli**, (2019), “Turning Dataset for Chatter Diagnosis Using Machine Learning”, Mendeley Data, v1, <http://dx.doi.org/10.17632/hvm4wh3jzx.1>
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, (2019), “Machine learning toolbox for Wavelet Packet Transform (WPT) and Ensemble Empirical Mode Decomposition (EEMD)”, Github repository.

## **CONFERENCE ACTIVITIES**

- **Minisymposium Co-organizer**, *Topological Signal Processing*, SIAM Conference on Applications of Dynamical Systems, May 2021
- **Minisymposium Co-organizer**, *Topological Time Series Analysis*, SIAM Conference on Mathematics of Data Science, May 2020 (*canceled due to COVID-19*)
- **Session Chair**, SIAM Conference on Applications of Dynamical Systems, May 2021
- **Session Chair**, SIAM Conference on Applications of Dynamical Systems, May 2019

## **SERVICE**

- **Reviewer**, Journal of Intelligent Manufacturing July 2021
- **Reviewer**, Journal of Intelligent Manufacturing May 2021
- **Reviewer**, SoftwareX February 2021
- **Reviewer**, Journal of Ambient Intelligence and Humanized Computing September 2020
- **Reviewer**, Measurement June 2020

## **PROFESSIONAL AFFILIATIONS & ORGANIZATIONS**

- **Member**, Association for Computing Machinery (ACM) March 2021 – present
- **Member**, American Society of Mechanical Engineers (ASME) October 2019 – present
- **Event Coordinator**, Michigan State University Turkish Student Association (MSU-TSA) June 2021 – February 2022
- **Treasurer**, Michigan State University Turkish Student Association (MSU-TSA) April 2019 – June 2021
- **Member**, Society for Industrial and Applied Mathematics (SIAM) November 2018 – present

## **LEADERSHIP**

- *Graduate Student Mentor for ACRES-REU* May 2021 – July 2021
- Co-mentored two undergraduate students who participate in Advanced Computational Research Experience for Undergraduates (ACRES-REU)
- Met with students once a week, provided them with guidance on their research, and answered their questions whenever needed

## **AWARDS**

- MSU Graduate Office Fellowship (\$5400) October 2021
- Student Travel Award - SIAM DS21 May 2021
- MSU Graduate Office Fellowship (\$5000) February 2020
- Sabanci Foundation Scholarship October 2013 - June 2018

## **TECHNICAL STRENGTHS**

**Programming:** Python, MATLAB, Julia, C/C++, OpenMP, MPI

**Software & Tools:** High Performance Computing, Sphinx,  $\text{\LaTeX}$ , Solidworks, Inkscape, Arduino