

Sunia Tanweer

MECHANICAL ENGINEERING DOCTORAL STUDENT, MICHIGAN STATE UNIVERSITY

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Education

Michigan State University

East Lansing, MI, USA

PhD in Mechanical Engineering - CGPA: 4.0/4.0

Sept 2022 - Ongoing

- **Courses:** Continuum Mechanics, Theory of Vibrations, Engineering Analysis
- **Supervisor:** Dr. Firas Khasawneh, Assistant Professor, Dept. of Mechanical Engineering

National University of Sciences and Technology (NUST)

Islamabad, Pakistan

Bachelors in Mechanical Engineering - CGPA: 3.95/4.00

2017 - 2021

- President's Gold Medal for Academic Excellence (highest CGPA in a batch of 110 students)
- Dean's List Scholarship in all semesters
- US Dept of State's fully funded undergraduate (UGRAD) Semester Exchange Scholarship for my 6th semester at University of Wyoming, WY, USA
- Senior year project: Design and analysis of a cost-efficient power attachment for a manual wheelchair

Research and Work Experience

Michigan State University

East Lansing, MI, USA

Research Assistant

Sep 2022 - Ongoing

- Working as a research assistant to study dynamical systems and bifurcations using computational topological data analysis.

Engro Fertilizers Limited

Daharki, Pakistan

Graduate Trainee Engineer (Maintenance)

Oct 2021 - June 2022

- Utilized **1SAP for preventive and corrective maintenance** management through notifications and work orders, and for raising purchase requisitions (PR) to procure materials and services.
- **Developed and enriched maintenance manual procedures** pertaining to NARF handling, Shaft Installation of API 611 Steam Turbines, and overhauling/repair of Emergency Shut-off Valve (ESV) for GE-NP's API 612 Steam Turbines (SAC 1-8 and 1-4).
- Learned basics of stationary equipment inspection, NDTs, materials and common damage mechanisms in an ammonia/urea plant by acquainting myself with **APIs 510, 570, 571, 577 and ASME Section V**.
- Aided the implementation of a **hot box-up** weighing nearly 1 ton at a major leakage of Process Air (SS321H, 550°C, 40 kg/cm², 50ft height), preventing a forced outage of Enven plant for 5-6 P2P days.

Computations for Advanced Materials and Manufacturing Lab

University of Wyoming, WY, USA

Research Assistant

February 2020 - December 2020

- Developed and verified user defined material subroutines (**uhyper and vumat**) of **Murnaghan model of hyperelasticity** for ABAQUS in free form Fortran language.
- Wrote a **structured mesh model for ABAQUS using MATLAB**, and utilized bash and python scripting for results' extraction, to detect corrosion using third order elastic constants' effect on second harmonic generated by a Lamb wave as a Non-Destructive Testing technique.
- Generated **preliminary results for a grant proposal on thermally initiated Frontal Polymerization** by establishing relationship of sample initial temperature, thermal conductivity, heat rate and trigger temperature with time required for initiating a front.

Fluid Mechanics Lab

NUST, Islamabad, Pakistan

Research Assistant

April 2019 - August 2019

- Managed the **development of a test bench for pipe network analysis** for use in semester project evaluation of FM-II for my own batch. Drafted and filed a patent application for the bench.
- Reviewed **literature for a research project on subsurface drip emitters**, and devised an experimental setup for the project.

Robotics and Intelligent Systems Engineering Lab

NUST, Islamabad, Pakistan

Robotics Research Intern

June 2018 - September 2018

- **Collected data (Myoband EMG, Emotiv EEG, Nao Humanoid Robots) and statistically analyzed (MATLAB)** it to study alleviation of symptoms of autism in children between 4 and 14 years of age using robots.
- Conducted a rigorous **literature review to evaluate and design various experimental models** for understanding the relationship between physiological parameters and autism, and to stretch that learning to minimize the symptoms of autism.

Conference & Journal Publications

- Zhao, C., **Tanweer, S.**, Li, J., Lin, M., Zhang, X., & Liu, Y. (2021). Nonlinear Guided Wave Tomography for Detection and Evaluation of Early-Life Material Degradation in Plates. *Sensors*, 21(16), 5498.
- Zhao, C., **Tanweer, S.**, Li, J., Lin, M., Zhang, X., & Liu, Y. (2021, July). Early Fatigue Damage Evaluation of Nonlinear Guided Wave Imaging in Hyperelastic Materials. In *Quantitative Nondestructive Evaluation* (Vol. 85529, p. V001T11A009). American Society of Mechanical Engineers.
- **Tanweer, S.**, Khasawneh, FA., & Munch, E., "Robust Zero-crossings Detection in Noisy Signals using Topological Signal Processing," arXiv:2301.07703v1 [cs.CG], Jan. 2023. (*Arxiv Preprint*)

Presentations

- "Robust Zero-Crossing Detection with Persistent Homology", 2nd MSU CMSE Data Science Student Conference (DISC). Michigan State University, East Lansing, MI, December 2022.

Semester Projects

- *Dynamics*: Designed and manufactured an **Internal Pipe Climber** of adjustable diameter.
- *Thermodynamics*: Guided a team of four members to model the intake manifold of a TCC-III engine, and simulate the flow inside it using ANSYS Fluent and CFD-POST, to observe the **effect of Reynolds number and velocity profile** on secondary flow.
- *Fluid Mechanics*: Directed a team of three members to design a **Pipe Flow Network** and develop an Excel code for solving it, such that the network provided required pressure heads at specified nodes.
- *Solid Mechanics*: Designed and analyzed a chassis and pressure vessel based **Lunar Electric Rover**.
- *Heat and Mass Transfer*: Simulated and compared one-dimensional steady-state heat transfer in multiple commonly used **fin profiles** using ABAQUS.
- *Computer Aided Design*: Modelled a single-cylinder **oscillating steam engine** using Pro/Engineer.
- *Fracture Mechanics*: Simulated and analyzed a cracked aluminum single-edge notched beam (**SENB**) under a displacement controlled three-point bending condition.
- *Control Systems*: Implemented an Octave script for **Routh-Hurwitz Criterion** of stability.

Skills

Programming	Python (NumPy, Scikit-learn, Matplotlib, Openpyxl etc.), C++, MATLAB/Octave, Fortran
Computer Aided Design	ProEngineer / Creo, Solidworks, AutoCAD, SpaceClaim/DesignModeler
FEA / CFD	ANSYS, Abaqus, Comsol, SolidWorks
Miscellaneous	Ubuntu Linux, Microsoft Office, \LaTeX

Achievements

- Studied 6th semester of BE Mechanical at University of Wyoming (Laramie, WY, USA) under US State Department's fully funded merit-based **Global UGRAD Semester Exchange Scholarship**. Selected out of 14000+ applicants from all over Pakistan – President's Honor Roll
- Awarded **NESCOM's undergraduate fellowship** of 2019 from the entire batch of 110 students
- Nationwide **first position in NUST entrance test** 2017 out of 70000+ students achieving Chancellor's scholarship in 1st semester
- Among the top 25 participants in National Round (Pakistan) of International Physics Olympiad (IPhO) 2017 (**NPTC-21**) out of 5000+ students
- **Merit scholarship by Federal Board Islamabad (FBISE)** for 6th position in Pakistan (HSSC 2017)
- Special Mention in **South Asia Model United Nation (SAMUN)** 2017 for UNSC

Extracurricular Activities

Webmaster	Institution of Mechanical Engineers (IMechE), Pakistan (Sep'18-Dec'19)
Student Vice Chair	IMechE NUST Student Chapter (Jan'19-Sep'19)
Student Director Liaison	IMechE NUST Student Chapter (May'18-Jan'19)
Executive Human Resources	NUST Science Society (Sep'17-Jul'19)
Mentoring	Taught Computer Programming (C++) to freshman batch 2018 at NUST-SMME
TABA-NUST Student Chapter	Established and handled finances and social media marketing for 'Sponsor a Child' project of TABA.
Student Grievances Committee	Batch representative on the Student Grievances Committee throughout my undergraduate studies.