Yiorgos (Georgios) Kostopoulos

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Summary

I am a dedicated and ambitious individual currently in my 5th and final year of pursuing a mechanical engineering degree with a specialization in machine learning at the National Technical University of Athens (NTUA). Over the past 2+ years, I have actively engaged in cutting-edge research projects at the Machine Design Laboratory (MDLab), combining expertise in FEA software, modeling, and end-to-end machine learning models managment to drive innovation. With 10 years of service as a police officer, including experience at police headquarters and critical intelligence sectors. I have honed strong math and physics background as well as analytical and problem-solving skills, ready to tackle complex challenges.

Work Experience

Associate Researcher at MDLab - NTUA Oct 2021 - present

- Developing cutting-edge AI models to analyze and accurately predict gear dynamics.
- Conducting comprehensive multi-objective optimization of gear sets, with a focus on boosting performance and efficiency.
- Possessing proficiency in the complete end-to-end lifecycle management of AI models, encompassing training, deployment, and maintenance, while adhering to industry-leading best practices akin to MLOps.

Police deputy sergeant Sep 2011 - present

- Skilled in making informed decisions in high-pressure situations
- Experienced in working under tight deadlines and managing multiple priorities simultaneously

Projects

Gears Forces and Displacements Analysis Toolkit Link to app

. The Static Transmission Error (STE) Analysis Toolkit is an app that utilizes deep learning technology to compute forces and displacements of gears in real-time

. The app consists of two main sections: "Explore STE" and "Optimization Tools"

. This allows for an in-depth analysis to be performed in a dynamic and efficient manner

. Check Optimization tools → Discrete Analysis for some descriptive graphs

Graph Neural Networks as Surrogate Models:
Predicting Displacements of Plates with Tension-loaded Holes Link to test cases diagrams

This project involves the development of a graph neural network (GNN) capable of accurately predicting displacements u_x and u_y for a plate with a hole under tension. The GNN is trained on a dataset derived from finite element analysis (FEA) simulations, ensuring the model's accuracy and reliability.

DC motor parameter estimation Link to technical report

. Estimating DC Motor parameters with numerical optimization techniques

. Processing and plotting data measured from an Arduino

. Utilizing SciPy's "leastsq" function for optimization and applying curve fitting and State-Space Representation techniques

Helical gears stresses FEA vs AGMA standards Link to technical report

This technical report provides a detailed analysis of gears using finite element methods, and compares the results with AGMA standards.

Thermodynamic Cycles Link to Github repo

. Modeling and constructing thermodynamic cycles with simulation software written in Python
. Calculation of important parameters (temperature, entropy, work) and creation of diagrams (T-s, h-s, P-v)
. Utilizing Factory design pattern for code maintenance and future adaptability

Uncertainty Propagation Link to Github repo

. Quantifying uncertainty in scalar function outputs with Python libraries including NumPy, SciPy, Seaborn and Matplotlib
. Using Delta method and Monte Carlo simulation, allowing for customization with user-defined inputs such as functions, input variables, covariance matrix, and sample size
. Computing uncertainty, generating samples, plotting distributions, calculating standard error of mean and confidence band, and offers flexibility in application to a variety of functions and inputs

Education

2019 - present Five-year MEng. Diploma at **School of Mechanical Engineering - National Technical University of Athens (NTUA)**
. Mechanical Design Major
. Currently at 5th year

2014 - 2018 Bachelor's Degree at **Department of Mechanical Engineering Educators - School of Pedagogigal and Technological Education (ASPETE)**
. 40 courses passed
. Drop out

2011 - 2013 Constable's Degree at **Hellenic Police Constable School - Police Academy**.

Publications

[1] E. Sakaridis, C. Kalligeros, C. Papalexis, G. Kostopoulos, and V. Spitas, "Symmetry preserving neural network models for spur gear static transmission error curves," *Mechanism and Machine Theory*, vol. 187, p. 105 369, 2023, ISSN: 0094-114X. DOI: https://doi.org/10.1016/j.mechmachtheory.2023.105369. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0094114X23001404.

Skills

Technical Skills	**Tools & Technologies**
Python, Matlab, LaTeX	Anaconda, Jupyter Notebook, Git
Machine Learning, Deep Learning	PyTorch, TensorFlow, Keras, MlfLow
FEA	Abaqus, Calculix, GMSH, Netgen
Data Analysis, Data Visualization	Pandas, Matplotlib, Seaborn
Docker	Docker Compose
Database Management	MySQL, PostgreSQL, MongoDB
Web Development	HTML/CSS, Flask