Sher Muhammad Nizamani

Mechatronics Engineer | Sensor Systems | Signal Processing | Applied Machine Learning

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Personal Website: https://shernizamani.pages.dev/ | **CIRCOPAV Project:** https://circopav.com

PROFESSIONAL SUMMARY

Marie Sklodowska-Curie PhD Researcher at the University of Parma with an MSc in Mechatronics Engineering and a BSc in Mechanical Engineering. Hands-on experience in MEMS sensor data acquisition, Python signal processing, time-series analysis, applied machine learning, and validation against reference laboratory measurements. Develops reproducible workflows that convert noisy force, displacement, acceleration, temperature, and frequency data into reliable engineering results. Interested in sensor engineering, machine learning, mechatronics, test and validation, robotics perception, and industrial R&D roles.

CORE TECHNICAL SKILLS

Programming and analytics: Python, NumPy, SciPy, Pandas, Matplotlib, scikit-learn, data cleaning, feature engineering, regression, classification, cross-validation, model evaluation, technical visualization

Signal processing: Time-series analysis, detrending, baseline correction, digital filtering, FFT, PSD/Welch analysis, sine fitting, amplitude/frequency/phase extraction, SNR and signal-quality assessment

Sensors and data acquisition: ADXL355 MEMS accelerometers, Raspberry Pi 5, SPI/I2C interfaces, Python logging, Linux workflows, LVDTs, force measurements, temperature measurements, instrumentation setup

Machine learning: Linear and nonlinear regression, tree-based and boosting models, support vector regression, neural-network workflows, feature importance, grouped validation, R2, MAE, RMSE, MAPE

Engineering and research: Experimental design, sensor validation, controlled mechanical testing, AASHTO T 342 complex modulus testing, technical reporting, scientific writing, academic-industrial collaboration

RESEARCH AND PROFESSIONAL EXPERIENCE

PhD Researcher - CIRCOPAV Marie Curie Project | University of Parma | Parma, Italy **Apr 2023 - Present**

- Design and validate sensor-based experimental workflows using ADXL355 MEMS accelerometers, Raspberry Pi 5 data acquisition, Python logging, and MTS/LVDT reference measurements.
- Develop Python pipelines for raw time-series import, cleaning, synchronization checks, target-frequency filtering, FFT/PSD analysis, sine-fit amplitude extraction, frequency and phase analysis, and automated figures and tables.
- Compare accelerometer, force, and displacement measurements to evaluate signal quality, repeatability, frequency response, amplitude consistency, and measurement reliability under controlled cyclic loading.
- Process engineering datasets combining acceleration, LVDT displacement, force, loading frequency, temperature, complex modulus, and phase angle.
- Build and compare machine-learning regression workflows using feature engineering, train-test evaluation, cross-validation, leave-one-temperature-out, leave-one-frequency-out, and leave-one-specimen-out validation.
- Assess models using R2, MAE, RMSE, MAPE, residual analysis, and measured-versus-predicted plots, with attention to overfitting, extrapolation, and data leakage.
- Prepare experimental procedures, data-processing documentation, technical reports, research figures, literature reviews, thesis material, and journal manuscripts.
- Coordinate experimental work and data interpretation with academic and industrial collaborators, including InfraTest GmbH and Technische Universitat Braunschweig.

Lecturer | Indus University | Karachi, Pakistan **2021 - 2022**

- Taught undergraduate engineering courses and supported laboratory, assessment, and departmental academic documentation.
- Supervised student projects involving robotics, Arduino-based systems, sensors, automation, obstacle avoidance, line following, ultrasonic distance measurement, Bluetooth control, and electromechanical prototypes.
- Guided students through engineering design, testing, troubleshooting, data interpretation, and technical report preparation.

SELECTED TECHNICAL PROJECTS

Sensor Data Acquisition and Reference-Measurement Validation | *University of Parma*

- Integrated MEMS accelerometers and Raspberry Pi-based acquisition with controlled laboratory loading and reference MTS/LVDT measurements.
- Used harmonic regression and frequency-domain analysis to estimate amplitude, frequency, and phase from noisy signals and to compare accelerometer-derived displacement with reference measurements.
- Produced structured datasets and repeatable processing workflows for multi-frequency and temperature-dependent experiments.

Applied Machine Learning for Engineering Material Response | *PhD research*

- Developed predictive workflows for complex modulus and phase angle using temperature, loading frequency, force, displacement-related variables, and sensor-derived features.
- Compared linear, kernel-based, tree-based, boosting, ensemble, and neural-network approaches under identical validation schemes.
- Investigated feature importance, model generalization, small-data limitations, target leakage, and performance on unseen temperatures, frequencies, and specimens.

Industry-Academia Sensor-System Collaboration | *InfraTest GmbH and TU Braunschweig*

• Implemented Raspberry Pi-based data-acquisition and Python preprocessing workflows for repeated sensor measurements under controlled laboratory loading.

• Coordinated instrumentation checks, data-quality review, reproducible test workflows, and engineering interpretation with academic and industrial collaborators.

GPS Estimation Using Kalman Filter | *MSc Mechatronics Engineering*

- Applied Kalman filtering to state estimation and noisy GPS measurements, providing a foundation in probabilistic sensor fusion and measurement uncertainty.

EDUCATION

PhD in Civil Engineering - Ongoing **Apr 2023 - Present**

University of Parma | *Parma, Italy*

- Marie Sklodowska-Curie CIRCOPAV doctoral project; research in sensor-based measurement, signal processing, machine learning, and experimental material characterization.

MSc in Mechatronics Engineering **Mar 2015 - Jan 2019**

Mehran University of Engineering and Technology | *Pakistan*

- CGPA: 3.79/4.00 | Thesis: GPS Estimation Using Kalman Filter

BSc in Mechanical Engineering **Dec 2009 - Jul 2014**

Quaid-e-Awam University of Engineering, Science and Technology | *Pakistan*

SELECTED PUBLICATIONS

• Nizamani, S. M., Nizamani, M. M., and Nizamani, R. A. (2025). An integrated deep learning-based approach for traffic maintenance prediction with geographic information system data. In Deep Learning for Earth Observation and Climate Monitoring. Elsevier.

- Yao, Y., Yang, J., Gao, J., Xu, J., Zhang, Y., Yu, S., and Muhammad, N. S. (2025). Blending behavior of reclaimed asphalt and virgin asphalt in recycled asphalt mixtures. Construction and Building Materials, 465, 140229.
- Muhammad, S., Laghari, N.-u.-Z., Ali, M., and Farrukh, M. (2018). GPS estimation using Kalman filter. International Journal for Scientific Research & Development, 6(6), 692-694.

TRAINING, AWARD, MEMBERSHIP AND LANGUAGES

Selected training: B2 English Course; English for Academic Purposes; Advanced Material Characterization; CIRCOPAV Training Week; Introduction to Geostatistics; Digital Road Management training
Award: Marie Sklodowska-Curie Doctoral Fellowship, CIRCOPAV Network, European Commission, 2023
Professional membership: Registered Engineer, Pakistan Engineering Council, 2014
Languages: English (B2), Urdu, Sindhi

REFERENCES

Prof. Elena Romeo: Associate Professor, University of Parma, Italy | elena.romeo@unipr.it
Prof. John D. Hedengren: Associate Professor, Brigham Young University, USA | john_hedengren@byu.edu
Prof. Valentina Emilia Balas: Full Professor, Faculty of Engineering, Aurel Vlaicu University of Arad, Romania | valentina.balas@uav.ro