Md Imran Khan

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Professional Summary

Engineer with Ph.D. training in optics and nearly four years of semiconductor manufacturing experience in imaging system characterization and CD-SEM metrology at Intel. Experienced in calibration, measurement performance analysis, and development of Python-based workflows for evaluating tool stability and sensor performance in high-volume environments. Interested in roles involving imaging systems, sensor analytics, and data-driven diagnostics for semiconductor equipment and inspection technologies.

Technical Skills

- **Programming & Scientific Computing:** Python (NumPy, SciPy, pandas, OpenCV, scikit-image, Matplotlib), MATLAB, SQL, Git, Jupyter
- **Imaging & Signal Analysis:** Time-series analysis, FFT analysis, focus/sharpness metrics, texture analysis (GLCM), noise and contrast evaluation, anomaly detection
- **Process & Measurement Analytics:** Statistical Process Control (SPC), multivariate analysis, tool matching, performance validation, DOE
- **Imaging Physics & Modeling:** SEM/CD-SEM metrology, electron-optical systems, wave optics, RCWA modeling

Experience

Metrology Process Engineer (CD-SEM)
Intel Corporation, Hillsboro, OR | November 2021 – August 2025

- Developed automated calibration and imaging performance validation workflows for a fleet of 8 CD-SEM tools to improve measurement stability and reduce drift-related variability.
- Implemented multivariate statistical analysis pipelines for tool-to-tool comparison and measurement precision evaluation, reducing analysis time from ~5 hours to under 1 hour.
- Evaluated imaging system acquisition parameters and metrology target performance to improve measurement accuracy across production tools.
- Supported SPC-based monitoring of imaging sensor performance using large-scale FCCD/DCCD datasets.
- Developed measurement sampling strategies to support qualification of new process layers and product lines following installation or process integration.
- Contributed to tool matching and performance validation to ensure measurement consistency across imaging-based metrology platforms.
- Collaborated with hardware and software teams to investigate electron-optical drift and optimize image acquisition.

TECHNICAL PROJECTS

SEM Semantic Segmentation (Ni-WC Composites) | PyTorch, PIL

- Built a multi-class semantic segmentation pipeline for SEM microstructure images using U-Net (scratch + pretrained encoders) in PyTorch to segment five material phases (matrix, carbides, voids, dilution, reprecipitated).

- Designed a training workflow for highly imbalanced scientific image data, implementing label remapping, class-weighted CE + Dice loss, and per-class IoU/Dice evaluation, achieving strong segmentation performance on dominant phases.

SEM Image Quality Analysis Toolkit | Python, OpenCV, scikit-image

- Imaging sensor characterization and performance diagnostics toolkit for SEM images, implementing full-reference (SSIM, PSNR) and no-reference (Laplacian sharpness, FFT high-frequency energy, variance-based focus) metrics to assess focus, contrast, and noise.

Education

- Ph.D., Physics (Optics & Computational Modeling), UC Merced | August 2016 – October 2021
- M.S., Physics, Binghamton University (SUNY) | May 2016

Research Experience

Graduate Research Scholar
University of California, Merced, California. | Aug, 2016 - Oct, 2021

- **Full-Wave Modeling:** Developed a hybrid modeling framework (MFS and Foldy-Lax theory) to simulate 3D nanoplasmonic scattering and broadband cloaking.
- **Experimental Validation:** Nano-fabricated core-shell meta-structures and correlated experimental scattering measurements with simulation predictions, demonstrating strong agreement in optical response.
- **Metrology Design:** Designed and aligned a high-stability TRPL measurement system optimized for very weak emitters; quantified photoluminescence lifetime changes to distinguish energy-transfer regimes.

Publications (Selected)

- Khan, M.I., et al., "Scattering by nanoplasmonic mesoscale assemblies," JOSA A 42, 1244–1253 (2025).
- Khan, M.I., et al., "Modeling broadband cloaking using 3D nano-assembled plasmonic meta-structures", Optics Express, 2020.

Awards & Affiliations

- NSF-CREST Graduate Scholar, CCBM, UC Merced
- Graduate Scholar Mentor – Mentored undergraduate researchers on experimental methods and graduate school preparation