Swapnil More

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EXPERTISE

Ultrasensitive measurements, nanofabrication, building scientific experiments

EDUCATIONAL QUALIFICATION

Degree	Institute / School	CGPA / %	Year
Doctor of Philosophy	IISc, Bangalore	7/10	Aug 2022
MTech Nanotechnology	IISc, Bangalore	6.4/8	July 2016
BE in Mechanical Eng.	University of Pune	69%	July 2012
Diploma in Mechanical Eng.	Govt. Polytechnic, Pune	86%	July 2009

RELEVANT TECHNICAL SKILLS

Semiconductor Fabrication: E-beam lithography, Photolithography, RIE, DRIE, CMOS wet bench processes, Thermal/E-beam evaporation, SEM, AFM.

Scientific Experiment Design: Scientific instrument control, liquid Helium cryostat, Vacuum system design, Free space optics, Soldering, PCB design.

REFERENCES

	Prof. Akshay Naik Research supervisor	Prof. Prosenjit Sen Course Instructor
Email	anaik@iiac.ac.in	prosenjits@iisc.ac.in
Contact Priority	Primary. Can be contacted before the interview.	Secondary. Please inform me before contacting Prof. Sen

RELEVANT WORK EXPERIENCE

COMPUTATIONAL LITHOGRAPHY (INTERN, GLOBAL FOUNDRIES, BANGALORE)   AUG'22 – JAN'23

- Developing model-based, rule-based OPC and SRAF recipes, Etch modeling, and ILT techniques for full chip layouts using Siemens Calibre WORKbench (GUI + SVRF).
- Simulating accurate print image, development contour, and etch contour by optimizing optical, resist and etch models.
- Fourier optics simulations to understand the diffraction limits of lithography
- Processing full chip layout data using EDA tools, reviewing CMOS design rules, photo mask manufacturability rules, optical rules for the simulated print image
- Shell scripting, automating the testing process using python.

RESEARCH SCHOLAR (IISC, BANGALORE)   AUG 2016 – AUG 2022

Nanofabrication and characterization:
- 6 years of class 100 cleanroom fabrication experience.

- ➢ Expertise in Photo/e-beam lithography, Dry/Wet etching, thin film deposition, exfoliation-transfer-characterization of 2D materials, fabrication process flow design, statistical process control, wafer/die handling, yield optimization.
- ➢ Experienced in imaging nanoscale devices, physical and material characterization.

2D-NEMS and MEMS sensors:
- ➢ Developed nanoelectromechanical sensors with strain tunability.
- ➢ Studied the effect of strain on linear and nonlinear dynamics, mode coupling, dynamic range, limit of detection, and quality factor of resonant sensors.
- ➢ Gained expertise in MEMS/NEMS design, nanofabrication, ultrasensitive measurement, design of experiments and scientific data analysis.

Ultrasensitive measurements:
- ➢ Experience with lock-in amplifiers (ZI, SRS), RF Signal generators, DC source meters, RF signal processing, PLL, and PID controllers.
- ➢ Remote control of scientific instruments through MATLAB / Python scripting.
- ➢ PCB fabrication, SMD soldering, wire bonding of nanodevices.

MEMS / NEMS Sensor packaging: Developed a packaging scheme for NEMS sensors that achieves the following
- ➢ Vacuum cavity for nano resonator
- ➢ Coupling of external stimuli with NEMS through a MEMS device
- ➢ Electrical and optical feedthrough for electrical and optical readout

Design of Experiments: Developed various experiments, such as
- ➢ Electrostatic actuation and detection of mechanical resonance
- ➢ Electromagnetic and piezoelectric actuation of Silicon diaphragm to strain NEMS fabricated on the Silicon diaphragm.
- ➢ Mechanically coupled NEMS with strain tunable coupling.
- ➢ Free space optics for optical detection of mechanical resonance.

Data analysis and hypothesis testing:
- ➢ Maintaining clean and unambiguous datasets of the experiments
- ➢ Extracting the dynamical behavior of NEMS from the raw experimental data through noise subtraction, data visualization, and model fitting.
- ➢ Extra emphasis is given to statistical hypothesis testing by performing repeated studies under curated experimental conditions.

Publications:
- ➢ Nanomechanical Resonators: Toward Atomic Scale, ACS Nano 2022
- ➢ Strain engineering of graphene nano resonator, JMM. 31 045015, 2021
- ➢ Ultra-sensitive charge detection and latch memory using MoS_2-nanoresonator-based bifurcation amplifiers, Appl. Phys. Lett. 118, 053105 (2021)
- ➢ Fabrication of 2D NEMS on Flexible Substrates for Strain Engineering in Sensing Applications, IWPSD 2017. Springer Proceedings in Physics, vol 215. Springer, Cham

Conferences:
- ➢ Dynamic frequency tuning of 2D NEMS, NMC 2022, IISc Bangalore.
- ➢ Manipulating Internal Resonance and Coupled Modes in NEMS, NMC 2019, EPFL Lausanne, Switzerland.
- ➢ Modeling Internal Resonance in 2D NEMS, International Conference on Nonlinear Solid Mechanics (ICoNSOM), Rome, Italy (June 16-19, 2019).

OTHER TECHNICAL SKILLS

Programming Languages: Python, MATLAB, JavaScript, Mathematica, LabVIEW
Design tools: COMSOL, Autodesk Inventor, CATIA, Blender
Data Science: Machine learning, 2D/3D visualization, data cleaning, optimization.
EDA: Siemens Calibre WORKbench, Full chip layout simulations for RET
Web Development: HTML, CSS, React
Machine Learning Stanford Online, MOOC by Prof. Andrew Ng [Certificate](#)

ACADEMIC WORK

PH.D. THESIS (IISC, BANGALORE, 2016-2022)
Strain tunable nanoelectromechanical system (NEMS) for sensing applications.
- Design, fabrication and packaging of strain tunable NEMS sensors.
- Demonstration of linear pressure sensing, dynamic strain sensing, and nonlinear bifurcation amplifier for pressure sensing and logic operations.

MASTER'S THESIS (IISC, BANGALORE, 2015-2016)
Fabrication of nanoelectromechanical system (NEMS) on flexible substrates
- Developed a nanofabrication method for NEMS on flexible substrates.
- Designed a motorized actuator to bend flexible substrate so that the strain on NEMS can be tuned during an experiment.

BATCHELOR'S PROJECT (UNI. PUNE, 2011-2012)
Design of transverse electric mode cell for testing for ICs for EM compatibility
- The cell was designed as per requirements provided by the Automotive Research Association of India (ARAI).
- The designed TE-Mode cell allowed testing of EM emission from the automotive ICs as well as testing the ICs for EM compatibility till 100 MHz.

DIPLOMA PROJECT (GOVERNMENT POLYTECHNIC, PUNE, 2008-2009)
Pneumatic automation using the programmable logic controller
- Simulated various tasks for automated general-purpose assembly lines using pneumatic actuators and valves.
- The pneumatic actuation was controlled through PLC.
- The PLC provided flexibility to connect and operate actuators and valves according to the assembly process requirements.

TEST SCORE(S)

GATE – 2014 Mechanical Engineering: 911/1000, All India Rank 59

NON-ACADEMIC PROJECTS (FOR FUN!)

Dashboard for controlling scientific experiments
[Webapp](#) to control and monitor the scientific experiments at NEMS-Lab.
Discord chatbot for simulating quantum circuits and for solving differential equations
[A smart chatbot](#) that simulates basic quantum circuits and solves nonlinear differential equations on the fly.
Blockchain applications for renting robots
A simple [payments app](#) and its [extension to rent](#) out IoTs on Ganache test net.

OTHER PROFESSIONAL EXPERIENCE

PROJECT ASSISTANT (IIT MUMBAI)   FEB 2013 – DEC 2013
Study and design of heating, ventilation and air conditioning system

GRADUATE ENGINEER TRAINEE (MAHINDRA & MAHINDRA)   AUG 2012 – JAN 2013
Sales and dealer development