Swapnil More

swapnilmore@iisc.ac.in
swapnil2me.github.io
Ref: Prof. Akshay Naik, email: anaik@iisc.ac.in

RESEARCH INTEREST

N/MEMS, Microfluidics, Lab on Chip, Micro/Nanofabrication, Ultrasensitive measurements

EDUCATIONAL QUALIFICATION

Degree	Institute / School	CGPA / %	Year
Doctor of Philosophy	Indian Institute of Science, Bangalore	7/10	Aug 2022
Master of Technology in Nanoscience and Engineering	Indian Institute of Science, Bangalore	6.4/8	July 2016
Bachelor of Engineering in Mechanical Engineering	University of Pune	69%	July 2012
Diploma in Mechanical Engineering	Government Polytechnic, Pune	86%	July 2009

WORK EXPERIENCE

DOCTORAL STUDENT (IISC, BANGALORE) — JAN 2016 – (COVID 19) – PRESENT

Strain engineering of 2D nanoelectromechanical systems (NEMS) (PhD Thesis):

- Developed a practical method to realize strain tunability of 2D NEMS.
- Studied the effect of strain on linear and nonlinear dynamics of NEMS.
- Strain tunability gives control over mode coupling, dynamic range and quality factor of the 2D NEMS.
- The designed 2D NEMS package is used for ultrasensitive measurement of external stimulus coupled to the 2D NEMS through the strain.

Nanofabrication and characterization:

- Used class 100 cleanroom to fabricate NEMS using 2D materials.
- Expertise in exfoliation, transfer and characterization of 2D materials.
- Knowledge of designing fabrication process flow, optimizing process parameters, wafer/die handling, and optimization for increasing process yield.
- Experience in imaging nanoscale devices, physical and material characterization and preparing reports for knowledge transfer.

Ultrasensitive measurements:

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

NEMS Sensor packaging:

Developed a packaging scheme for NEMS sensors that achieves the following

- Vacuum cavity for nano resonator
- Coupling of external stimulus with NEMS through substrate strain
- Electrical and optical feedthrough for electrical and optical readout

Design of Experiments:

Developed various experiments to study diverse phenomena with NEMS, such as

- Electrostatic actuation and detection of mechanical resonance
- Electromagnetic 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 behaviour 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:

- Strain engineering of graphene nano resonator, J. Micromech. Microeng. 31 045015, 2021
- Ultra-sensitive charge detection and latch memory using MoS2-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:

- Manipulating Internal Resonance and Coupled Modes in NEMS, NMC 2019, Lausanne.
- Modelling Internal Resonance in 2D NEMS, International Conference on Nonlinear Solid Mechanics (ICoNSOM), Rome, Italy (June 16-19, 2019).

PROJECT ASSISTANT (IIT BAMBAY) — JUNE 2013 – NOV 2013

Logistic and administrative support.

GRADUATE ENGINEER TRAINEE (M&M) — AUG 2012 – JAN 2013

Sales and dealer development:

- Conducting market surveys to understand customer requirements in the LCV segment.
- Organizing meetings between customers and financial service providers to boost product sales.
- Developing sales personnel's skills by designing product manuals and sales checklists.

ACADEMIC WORK

MASTER'S THESIS (IISC, BANGALORE, 2015-2016)

Fabrication of 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*

CERTIFICATION COURCE(S)

Machine Learning (Stanford Online, MOOC by Prof. Andrew Ng): *Certificate*

NON-ACADEMIC PROJECTS

Dashboard for controlling scientific experiments
Webapp to control and monitor the scientific experiments at NEMS-Lab.

Discord chatbot for solving differential equations and for simulating quantum circuits
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.

TECHNICAL SKILLS

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

Programming Languages: Python, MATLAB, JavaScript, Mathematica, LabVIEW

Design tools: Autodesk Inventor, CATIA, COMSOL, Blender

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

Data Science: 2D/3D visualization, data cleaning, optimization, model fitting, Hypothesis testing.

Web Development: HTML, CSS, React