Durgesh Tamhane
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EDUCATION

Ph.D. Electrical Engineering *(CPI: 8.14, Thesis submitted)* **2017 – 2022**
M.Sc. Physics *(61%)* **2009 – 2011**

EXPERIENCE

Ph.D., Department of Electrical Engineering, IIT Bombay **2017 – 2022**

Electromechanical impedance (EMI) based corrosion monitoring

- Proposed the use of EMI of a PZT transducer attached to a corroding material embedded in concrete to detect incipient corrosion and demonstrated the feasibility of the proposed idea by a proof-of-concept corrosion experiment and by simulating the effect of corrosion on mechanical resonant modes of a piezoelectric sensor on a sacrificial anode
- Eliminated the discrepancy between the simulation and experimental results by hypothesizing delamination of corrosion products
- Decreased the effect of loading due to the waterproofing of PZT on the EMI signature by using a 3D printed encapsulation
- Published in: IEEE Access (2021): 12230-12240, Tamhane, et al. "Smart cathodic protection system for real-time quantitative assessment of corrosion of sacrificial anode based on electro-mechanical impedance (EMI)."

Pulsed eddy current (PEC) based corrosion monitoring

- Verified the feasibility of PEC coils in the literature by simulations and modeled the effect of corrosion on PEC signals
- Corrosion detection by PEC relied on the analysis of the linear region of the PEC signal
- Demonstrated the application of a novel method of area under the curve of the PEC signal to achieve detection and showed the application of principal component analysis on the area under the curve data to enhance the corrosion distinction capability in terms of lift-off of the PEC sensor
- Published in: IEEE Sensors Journal (2021), Tamhane, et al. "Feature engineering of time-domain signals based on principal component analysis for rebar corrosion assessment using pulse eddy current."

Project Research Assistant, Department of Electrical Engineering, IIT Bombay **2015 – 2017**

Testing and packaging of soil sensor

- Designed and 3D-printed the prototypes for packaging of soil sensors which included DOE planning, experimentation, and data analysis for validation of soil sensors
- Demonstrated the use of a general-purpose humidity sensor as a soil-moisture sensor

Design and micro-fabrication of infrared Fabry-Perot etalon

- Micro-fabricated a silicon-based Fabry-Perot etalon in the infra-red region
- Simulated MgO-Ge mirror stack of an etalon using FEM for finesse optimization
- Achieved a free spectral range of 400 nm and finesse of 10 on a single wafer

Research Intern, University of Pune **2013 – 2014**

Synthesis & characterization of gold nanoparticles and their interaction with biomolecules
Fabrication of 3D microstructures within PDMS using wet chemical technique

Research Intern, Cochin University of Science and Technology **2011 – 2013**

Synthesized & characterized nanofluids for their application as coolants

- Synthesized magnetic and non-magnetic nanofluids by wet chemical technique
- Characterized the as-prepared nanofluids using XRD, UV-Vis-NIR Spectrophotometry, and FTIR
- Designed and fabricated a cost-effective thermal conductivity measurement probe to characterize the nanofluids
- 30% enhancement seen for thermal conductivities of synthesized nanofluids

PROJECTS

Detection of Defect in Steel Sheets Under Coatings by Magnetic Flux Leakage **2019**

- Demonstrated that a microcontroller-based system could detect defects in carbon steel sheets under various types of insulation coatings with a maximum thickness of 30.4 mm

Detection of wheel misalignment **2018**

- Developed an apparatus based on ST Microelectronics SensorTile module that could detect camber and toe misalignment in a wheel using the on-board 3D magnetometer data based on the change in the amplitude and the direction of the magnetic field intensity

Dependency of the splitting of the resonance frequency of a hemispherical shell **2018**

- Simulated a hemispherical shell using FEM and investigated the dependence of its resonance frequencies on its sphericity, shell thickness, and surface roughness

On the Electronic Detection of Heart Sounds **2017**

- Developed an electronic stethoscope that could detect S1 and S2 sounds of a heartbeat

TOOLS

Software	COMSOL, ANSYS, SolidWorks, LabVIEW
Instrumentation	Impedance analyzer, Digital Storage Oscilloscope, Arbitrary Frequency Generator
Programming	Python, MATLAB, C
Cleanroom	DSA photolithography, Thermal Evaporator, Plasma Asher, Profilometer, Ellipsometer, NIR-UV-VIS spectrophotometer, SEM, IV-CV probe station

AWARDS & CERTIFICATIONS

October 2021	KPMG's Lean Six Sigma – Green Belt Certification
August 2021	Excellence in Teaching Assistantship, EE 701: Introduction to MEMS, IIT Bombay
January 2020	Excellence in Teaching Assistantship, EE 617: Sensors in Instrumentation, IIT Bombay
October 2019	First Prize at the IEEE International Sensors and Measurement Student Contest, Canada
June 2019	Excellence in Teaching Assistantship, EE 783: Advanced Semiconductor Devices Lab, IIT Bombay
October 2018	First Prize at the IEEE International Sensors and Measurement Student Contest, India
January 2018	Third Prize in Texas Instruments sponsored Hackathon - Hardware category, IIT Bombay

COURSEWORK

- MEMS: Design, Fabrication, and Characterization
- Sensors in Instrumentation
- Non-Destructive Testing of Materials
- Computational Electromagnetics
- Microelectronics Laboratory
- Growth & Characterization of Nano-electronic Materials
- Structural Characterization of Materials
- Fiber Optic Communications
- Solid State Devices
- VLSI Technology

PUBLICATIONS & PATENTS

[1] **Durgesh Tamhane**, Sauvik Banerjee, and Siddharth Tallur. "*Monitoring corrosion in sacrificial anodes with pulsed eddy current and electromechanical impedance: A comparative analysis*", IEEE Sensors Journal (2022)

[2] **Durgesh Tamhane**, Jinit Patil, Sauvik Banerjee, and Siddharth Tallur. "*Feature engineering of time-domain signals based on principal component analysis for rebar corrosion assessment using pulse eddy current*", IEEE Sensors Journal (2021)

[3] **Durgesh Tamhane**, Jeslin Thalapil, Sauvik Banerjee, and Siddharth Tallur. "*Smart cathodic protection system for real-time quantitative assessment of corrosion of sacrificial anode based on electro-mechanical impedance (EMI)*", IEEE Access (2021)

[4] Thalapil Jeslin, **Durgesh Tamhane**, Sauvik Banerjee, and Siddharth Tallur. "*Vibration-based inverse graphical technique for thickness estimation of bulk acoustic wave (BAW) resonators: application for corrosion monitoring of sacrificial anodes*", Smart Materials and Structures (2021)

[5] **Durgesh Tamhane**, and Amit R. Morarka. "*On the Attenuation of Light by a Polydimethylsiloxane (PDMS) Foam and Its Implementation as a Weight Sensor*", Mapan (2017)

[6] **Durgesh Tamhane**, and M. R. Anantharaman. "*Design and Fabrication of a Simple and Inexpensive Measurement Probe for the Evaluation of Thermal Conductivity of Nanofluids*" Journal of Nanofluids (2017)

[7] Thalapil Jeslin, **Durgesh Tamhane**, Sauvik Banerjee, and Siddharth Tallur. "*Corrosion Monitoring of Sacrificial Anodes Based on Contour Plot Analysis of Electro-Mechanical Impedance Spectra*." In 21st International **Conference** on Solid-State Sensors, Actuators and Microsystems (Transducers), IEEE, USA, (2021)

[8] **Durgesh Tamhane**, Sauvik Banerjee and Siddharth Tallur, "Noninvasive detection of extent of corrosion in steel reinforcing bars by magnetic force measurement," presented at **Conference** on Non-Destructive Evaluation, India (2019)

[9] **Durgesh Tamhane**, Sauvik Banerjee, Siddharth Tallur and Jinit Patil, "*Apparatus and method for detecting corrosion of conducting material based on pulsed eddy current*," Indian **Patent** Application No. 202121019388, (2021)

[10] Siddharth Tallur, **Durgesh Tamhane**, Sauvik Banerjee, "*Method and Apparatus for an Electromechanical Impedance (EMI) based monitoring of sacrificial anode in a cathodic protection system*," Indian **Patent** Application No. 202021041671 (2020)

REFERENCES

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