ANNUAL REPORT 2025-26

CENTER FOR NON-DESTRUCTIVE EVALUATION

Glimpses of 25 years of CNDE

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Leadership Messages & Reflections

CNDE is a synergistic confluence for research, development, innovation, and entrepreneurship built by the passion, dedication, and perseverance of the students, research scholars, postdoctoral fellows, scientists, advisors, technical experts, administrative support staff and most importantly the faculty at IIT Madras over the past 25 years. CNDE Started in a small room with 2 assembled PCs in 2001 and with students such as Bhaskaran, Sashidhar, Naveen, Veera, Prabhu, and Srivaths who could generate amazing technical data and interpretation from very little resources. CNDE over the years has been inspired and blessed very important personalities, particularly Dr. Baldev Raj and then Director of IIT Madras R. Natrajan, and fueled by guidance from Profs. CRL Murthy and O Prabhakar, encouraged by Gen. Sundaram, Dr. R. Chidambaram, Prof. P. Rama Rao, and Dr Udpa, the CNDE grew rapidly and we were able to inaugurate and move into the current facilities by April 2001.

Along the way, CNDE is deeply indebted to several organisations and friends of CNDE, all of whom cannot be fit into this page. However, a few played an important role in the growth of CNDE such as Dr. Kharath and ARDE who gave the first project that enabled the development of a homemade C-scan imaging system, Drs. Upadyaya, Mangalgiri and Vijayraju from ADA for the deep involvement and support in composites SHM, Drs. Lahiri and Srinvas, from ASL, Dr. C. Muralidhar and his NDED team from DRDL, Dr. Makarand Joshi, Avinash, and Ramadas from R&DEE, Dr. Jayakumar, Venkatraman, AnishKumar, and the team from IGCAR, Dr. Nanekar and his team from BARC, Dr. PP Chandrachoodan from BRNS, Dr. Milind Kulkarni from DST, Drs. Mitra and Sagar from NML, Mr. Balamurugan and his team from Tata Steel, just to name a few.

The support from international societies, institutions and organization was another key partnership that CNDE has treasured along its journey, including the Karen from Corning Inc., Carol, Eric, and Charlie from Wright Pat Air Force Base in US, Steve Dixon from Warwick UK, Peter Cawley and Mike Lowe from Imperial College UK, Satish and Lalitha Udpa from Michigan State University USA, Raju and Chetan from Aurburn University USA, Sridhar Krishnaswamy and Jan Achenbach from Northwestern University, Pierre Calmon from CEA France, Michel Castaings from Bordeaux University France, Zigler from BAM Germany, Theobald Fuchs, Walter Arnold, and Micheal Kronig from Izfp Germany who gave CNDE the global flavor and allowed CNDE to host more than 150 students and scholars over extended periods.

One of the key differentiators in CNDE is the innovation and entrepreneurial culture of research and product development. I wish to thank all the students, scholars, and entrepreneurs who had either supported or become involved in the startup culture. CNDE startups have expanded globally and making CNDE technology work at scale that impacts industries worldwide.

I wish to thank each member of CNDE for their sacrifice and being a part of the building block of CNDE. I am looking forward to the next generation of CNDE with Prof. Prabhu Rajagopal, Prof Abhishek Saini, Prof. Tarun Naskar,Prof. Vivek Samu and others moving the needle to become the best eco-system in the world, making a difference.

I enjoyed every moment of this journey and am very proud of CNDE's accomplishments. I wish to assure Dr. Baldev Raj that his vision and his aspirations for CNDE will be pursued even more in the coming years.

Prof. Krishnan Balasubramanian
Institute Professor
"Class of 81" Chair Professor
Prof. in Charge of Gopalakrishnan Deshpande Center for Innovation & Entrepreneurship
Prof. in Charge of Accenture CoE for Product X
Prof. in Charge of Center for Advanced Automotive Research (CAAR)
Head of Centre for Nondestructive Evaluation

Reflecting on the 25 years of CNDE, personally, it gives me immense joy to share this message, but honestly don't know where to begin, or how to put all the emotions together in words. CNDE was where I started my academic journey, exploring acoustics, and probing the depths of ultrasonics. Years later, this is where I came back to, upon my return to India and IIT Madras starting as an academic. This is where my work and career have grown over the years addressing some of the toughest problems in asset integrity monitoring using NDE tools and allied technologies in robotics and data engineering. And this is where my work flowered over through publications, IP filings, academic collaborations, industry interactions and start-ups.

Reflecting back, a lot of this is thanks to the 'initial conditions' set by one of the modern day scientific greats and our guru-in-chief, in Prof Krishnan Balasubramaniam. I still remember when he had returned some 26 years ago to India and offered for many of us students of IIT Madras to work in his laboratory, it was a refreshing experience. He stood out as a Professor who not only provided us an excellent environment for intellectual investigations, but also went more than his way to support students on their paths to career fulfilment, whether it be in academia or industry. He sent several of us on internships abroad to some of the best NDE laboratories in the world, something that was unheard of in those days.

The stimulating discussions during the CNDE Wednesday weekly seminars, and the challenging problems we were all given to solve, even though we were merely a couple of years into the engineering program at IIT Madras, helped me and many of the fellow students of my batch, to step foot into the lofty world of genuine, international quality science. To this day, this intellectual rigour and academic discipline form the backbone of the 'CNDE way' coupled with the other major strand of our work in terms of industry interactions and international collaborations. All these ingredients were there right at the start and have only matured over the years.

It is the hallmark of the CNDE way of work to involve perspectives and problem statements from industry leaders in sectors such as energy, nuclear, space, automotive, manufacturing, and defence, to define our work and academic studies. Members from the industry, research facilities, and agencies have spent time in our laboratory, exchanging ideas and best practices. Today, as we embark on an ambitious journey, putting together the National Consortium for NDE (NCNDE), it is these interactions and networks that have come back to enrich our efforts.

We have had extensive and thoroughly enjoyable collaborations with scientists from all over the world, including colleagues from University of Bordeaux in France, Warwick, Imperial, Bristol and Newcastle in UK, Michigan State University, Iowa State University, and Northwestern University in the US, Ecole Superior in Montréal, Canada, BAM and IZFP Germany, Universities of Nairobi, Dedan Kimathi and Riara Kenya, NTU Singapore and Swinburne University of Technology Australia to name a few, besides industry partners, such as CEA and AIRBUS in France, and a range of multinational companies, including GE/Waygate, SITAS, ARTC Singapore, St Gobain Research India, TATA Steel, Renault Nissan, Daimler etc over the years.

We have had particularly extensive relationships with IGCAR and BARC, BHEL, NTPC-NETRA, MDL, NAL, HAL, HEML and a host of DRDO and ISRO laboratories in Pune, Hyderabad, Trivandrum and Sriharikota among the government, PSU and strategic sector bodies. Within the Oil & Gas and petrochemical refineries segment, we have had deep working relationships with major players, including RIL, IOCL, ONGC, BPCL, CPCL, HPCL Chevron, BP, Exxon Mobil and others.

CNDE has over the years contributed over 650+ journal articles and 100+ IP grants with hundreds of conference proceedings as well. Our students have won recognition at the best conferences in the NDE field across the world. This extensive academic output combined with partnerships with industry has led to a rich body of start-ups emerging from the group. We have produced 16+ start-ups over the last 15 years alone, including such prominent companies as Detect, Planys, Solinas and Xyma that are disrupting the asset integrity monitoring space and commercialising CNDE technologies in critical infrastructure maintenance across the country in areas such as marine, tank and pipe infrastructure and high temperature processes. Planys has for example inspected some of the most iconic marine sets in the country, including the Vivekananda Setu in Calcutta, Worli Sealink in Mumbai and the Pamban Bridge in Tamil Nadu. Solinas today maintains the water and sewer assets in over a dozen city across India through smart city projects , whereas their HomoSEP series of robots addresses a critical societal challenge in terms of manual scavenging and has already been deployed in 30+ locations across India.

More recently, CNDE start-ups, such as Plenome take us into expanded territories, such as healthcare and e-governance. Plenome's acclaimed Ashwin AI solution is soon to be deployed in the iconic AIIMS in Delhi , while it is already used for public health surveys in remote locations in Andhra Pradesh and Tripura, in partnership with the Apollo Total Foundation. A new crop of start-ups, including Dhvani AI, Matterize, Krishaka, Botforge, Terraclime, Nirbhav, Rail Labs, Folium sensing TIQ World and Satori are working on advancing AI/smart technologies in diverse domains, including manufacturing, automation, robotics and household water metering. Thanks to them, today, CNDE has presence in four continents. CNDE members and alumni serve in key industry bodies including the Indian Society for NDT nationally, and the Asia-Pacific Society for NDT, World Federation of NDT Societies and the International Committee for NDT internationally, as well as on editorial boards of acclaimed journals including Ultrasonics, NDT&E International and the national journal of NDT&E.

As we build the future of NDE through initiatives such as the NCNDE, I could perhaps lay down a five point value system that drives CNDE towards greater output and excellence: these include a commitment to academic rigour, freedom to pursue new and allied domains that advance the core of NDE technologies, collaboration with and benchmarking against the best across the world, working closely with industry and agency partners and taking the effort to translate our IP into real-world solutions through start-ups.

In recent years, several new colleagues have joined our efforts, from diverse departments including Electrical, Civil and Ocean engineering, Computer Science, and Applied Mechanics. As I had stated in the beginning, these few words would do very little justice for what all we have achieved under the umbrella of CNDE under the visionary and patrician leadership of Prof. Krishnan Balasubrahmaniam. However, perhaps the best is still yet to come, and we continue to dream and scale new heights and break new boundaries. Automation & AI, ubiquitous and passive sensing, working beyond natural limits, large area monitoring, distributed computing, and quantum are some of the 'sunrise' verticals powering us ahead on this path.

In 2024, we were one of the first academic NDE groups in India to appoint a Chief Executive Officer to oversee our burgeoning operations, and Mr V Manoharan, a doyen of NDE has provided exemplary leadership advancing our goals and activities, with an emphasis on strengthening core capabilities in R&D and skilling. We have appointed a Board of Advisors with eminent personalities from industry and academia guiding us forward. We are grateful to all our students, colleagues and collaborators, and industry partners who have stood with us in all our efforts. A word of gratitude also to our departments and Institute leaders who have supported us through some of the tough periods over the last few years, particularly Covid. This is welcoming the next 25 years of scientific outputs, Jai Hind!

Prof. Prabhu Rajagopal, FNAE
Director-in-Charge, IITM Zanzibar,
Dy Head, CoE on NDE 5.0, Core Faculty of School of I&E, Mukta Pai Fellow,
Nanjangud G Viswanath Swabhanu Leadership Chair Professor IIT Madras
Chairman, Plenome Technologies Pvt. Ltd

Celebrating 25 Years of CNDE: A Reflection

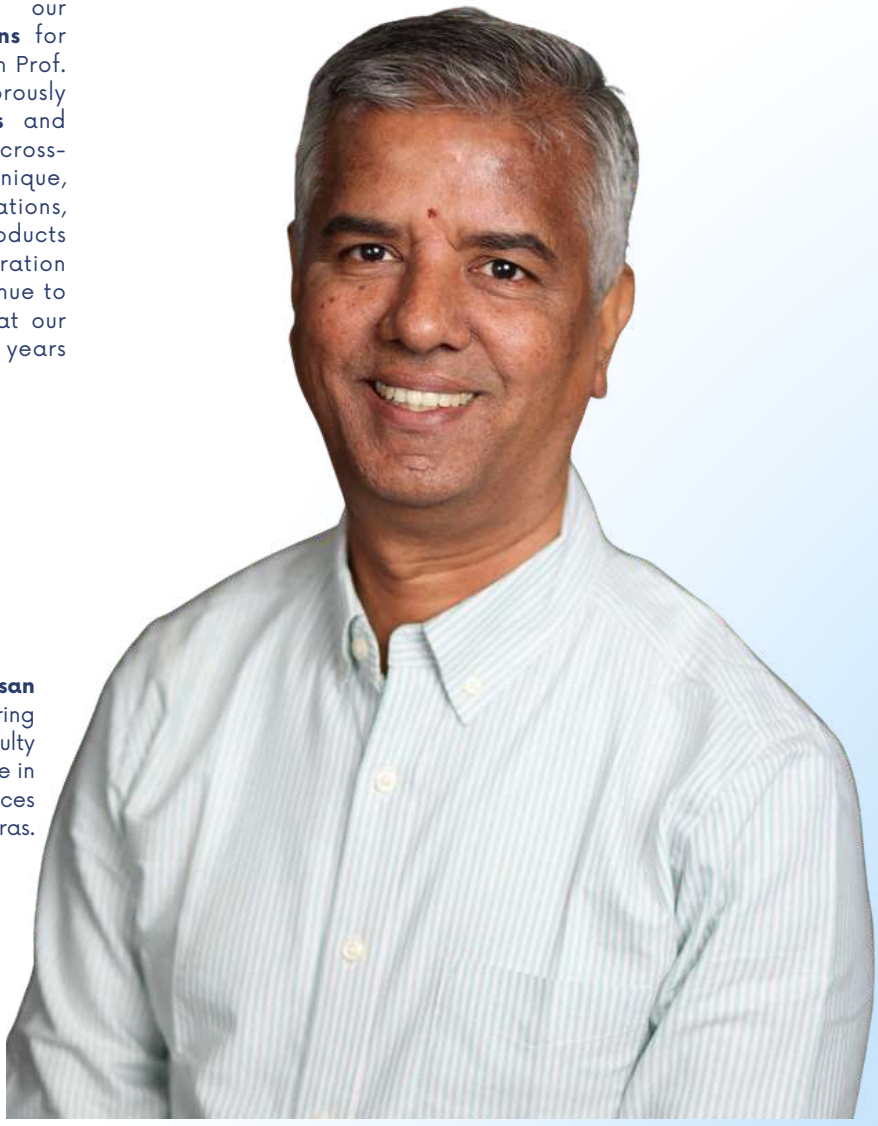
As I sit down to reflect on my 16-year association with CNDE, one phrase captures the essence of my experience: **Translational Entrepreneurship**. It is one thing to excel in science and technology; it is quite another to translate that technological excellence into real, field-deployable solutions. This has long been the central challenge in the Indian context-not that we fail to produce world-class research, but that most of it remains confined to laboratories.

It is now widely recognized that India's path to becoming a developed nation and unlocking its tremendous potential lies in its ability to undertake **translational research**. What is truly remarkable is that CNDE, under the visionary leadership of **Prof. Krishnan Balasubramanian**, recognized this 25 years ago! CNDE has consistently kindled the entrepreneurial spirit among young researchers, even as they push the boundaries of science and technology.

My journey with CNDE began through our collaborative development of **optical solutions** for non-destructive evaluation, initially working with Prof. Krishnan and later with **Prof. Prabhu**. We rigorously exchanged insights on **acoustics/ultrasonics** and **electromagnetics/photonics**, resulting in a cross-pollination of innovative ideas that led to unique, practical solutions. Numerous patents, publications, industry-relevant projects, and now startups/products stand as testament to the power of our collaboration under the CNDE umbrella. To this day, we continue to learn from each other, and I am confident that our partnership will only grow stronger in the years ahead.

So, what can we look forward to over CNDE's next 25 years? With the advent of **AI in Science and Engineering**, it is imperative that we pivot and embrace **AI-based solutions** for the numerous challenges in NDE. We are already on the cusp of such a dramatic change, with even a fledgling startup like Folium Sensing recognising this. But, we are still only scratching the surface of what's possible. This is where I believe the **Translational Entrepreneurship** will once again truly kick in-leading the change and propelling CNDE to even greater heights.

Congratulations to CNDE on its Silver Jubilee! Here's to a quarter-century of excellence and to a future filled with innovation, entrepreneurship, and transformative impact.



Prof. Balaji Srinivasan
Electrical Engineering
DST-IITM Pravartak Senior Faculty
Advisor, Internships & Placements, BS Degree in Data Sciences
IIT Madras.

RESEARCH TRANSLATION & INTELLECTUAL PROPERTY IMPACT

INNOVATING FOR IMPACT:
The IPR Landscape The institute has cultivated a robust and dynamic intellectual property portfolio that reflects its commitment to bridging the gap between laboratory discovery and real-world application. By fostering a multidisciplinary research environment and accelerating technology commercialization, we are building a globally competitive ecosystem dedicated to solving industrial and societal challenges. This summary highlights our recent surge in innovation and the strategic depth of our growing IP pipeline.

Key Metrics

390
TOTAL IPR RECORDS FILED

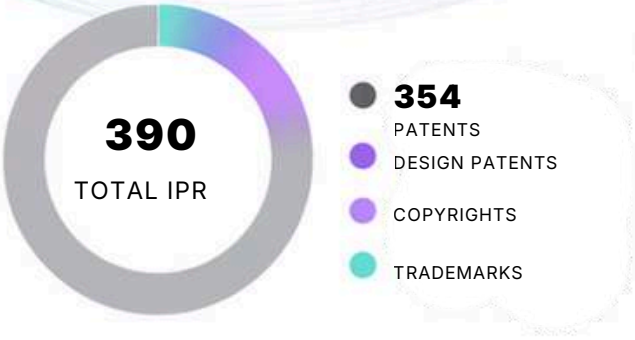
354
PATENTS

~50%
GRANTED/REGISTERED

70%
FILLINGS FRON INDIA

30%
OF TOTAL FILLINGS FROM FY2024 - 2025

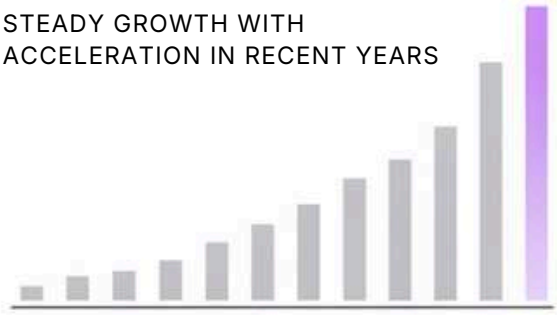
PORTFOLIO BREAKDOWN



GLOBAL FOOTPRINT

GROWTH TREND

STEADY GROWTH WITH ACCELERATION IN RECENT YEARS



2005 **2025**

FY24-25 CONTRIBUTED **~28%**

RESEARCH DOMAINS

- NON-DESTRUCTIVE EVALUATION & SHM
- CLEAN ENERGY, HYDROGEN & ADVANCED MATERIALS
- PHOTONICS,OPTICAL FIBER SENSING & COMMUNICATION
- BIOMEDICAL DEVICES & HEALTHCARE
- SUSTAINABLE CONSTRUCTION & INFRASTRUCTURE
- ROBOTICS, AUTOMATION & SMART AGRICULTURE

IMPACT AT A GLANCE

FROM RESEARCH TO REAL-WORLD IMPACT

RESEARCH
DISCOVERY & INNOVATION

→

IP CREATION
PATENTS, DESIGNS, COPYRIGHTS & TRADEMARKS

→

TECHNOLOGY TRANSLATION
INDUSTRY & GLOBAL COLLABORATIONS

→

REAL WORLD IMPACT
ENERGY HEALTHCARE INFRASTRUCTURE MANUFACTURING

Introduction

Introduction

The Centre for Non-Destructive Evaluation (CNDE) was established at the Indian Institute of Technology, Madras, in April 2001. The CNDE is Asia's leading academic center for Non-Destructive Evaluation (NDE) research and technology translation.

CNDE is uniquely positioned in the field of NDE research due to IIT's innovation ecosystem, which includes the Center for Innovation, Nirman-Pre-incubation support, the Incubation Cell, Research Park, and Industrial Consultancy & Sponsored Research - an administrative framework to take care of finance and legal compliance. CNDE has been focusing its research efforts on the following areas : Nondestructive Imaging & Evaluation, Structural Health Monitoring(SHM) and Measurements at Harsh Environments

CENTER FOR NON-DESTRUCTIVE EVALUATION

Mission

Deep - research based NDE for improved performance, enhanced safety, and increased life for industrial applications and societal well-being.

Vision

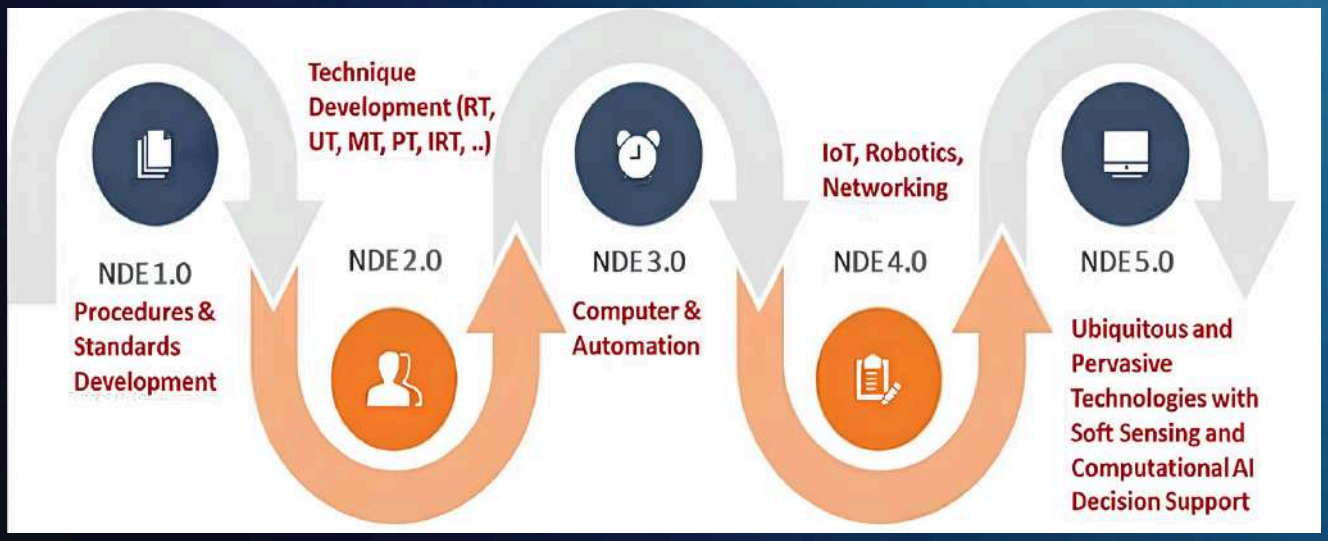
To become the world's largest Deep-research and technology translational center in the field of NDE.

NDE 5.0 Technologies

Asset Integrity and Process Monitoring technologies have a direct impact on operational costs by improving efficiency in labor, inventory, and support services. Timely and precise interventions enhance productivity, reduce material usage, and lower overall operational expenses. These needs have driven the development of NDE 4.0 over the past decade, with CNDE playing a key role in advancing, deploying, and translating these technologies through innovation and startup incubation.

NDE 4.0 introduced digitization, automation, and data-driven analytics, significantly improving inspection efficiency, repeatability, and large-scale data utilization. Building on this foundation, NDE is now undergoing a paradigm shift toward intelligent, autonomous, and decision-driven systems, termed NDE 5.0. This evolution integrates advanced sensing, physics-based modeling, artificial intelligence, and robotics to enable continuous, reliable, and context-aware assessment.

NDE 5.0 further advances toward adaptive, human-centric systems by incorporating continuous sensing, edge intelligence, and multi-modal data integration, enabling persistent structural awareness and more reliable decision-making while reducing human exposure in complex environments.



The NDEx.0 evolution chart

NDE 5.0: Transforming Inspection into Intelligent Infrastructure Awareness

NDE 5.0 will aim to create a knowledge base that leverages the current NDE 4.0 efforts but introduces new themes and concepts

UBIQUITOUS SENSING

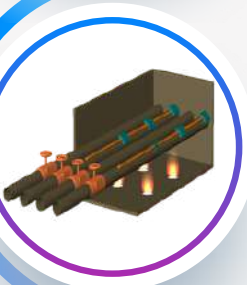
- Fibre Optic/Ultrasonic Waveguides
- Nano-functional Sensors

STRUCTURED MATERIALS FOR IMAGING

- Meta-materials based imaging & sensors
- Patterned surfaces for improved inspection
- Nano-structured coatings

EDGE INTELLIGENCE & SOFT-SENSING

- AI enabled rapid computations
- Simulated Assisted Decision Process
- Distributed computational Algorithms
- Reduced Order Computations



MULTI-MODAL INSPECTION

- Wide Multi-spectral Imaging (THz, IR, X-ray)
- Multi-modality Fusion Algorithms

REMOTE AND PERVASIVE INSPECTION

- Autonomous Robots
- Swarm Inspection Robots

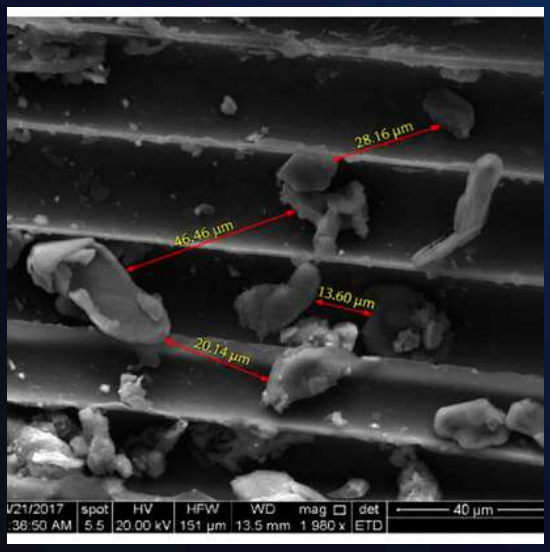
Theme 1: Ubiquitous Sensing Redefining Material State Awareness

The current state of the art in fiber optic sensing relies on Fiber Bragg Grating and similar discrete sensing elements. While effective for localized measurements, they face scalability challenges in large-area monitoring due to increased complexity and cost. Continuous sensing provides a more efficient alternative, enabling measurements along the entire sensing medium. Existing distributed techniques, such as Rayleigh scattering, offer wide coverage but are limited in spatial resolution.

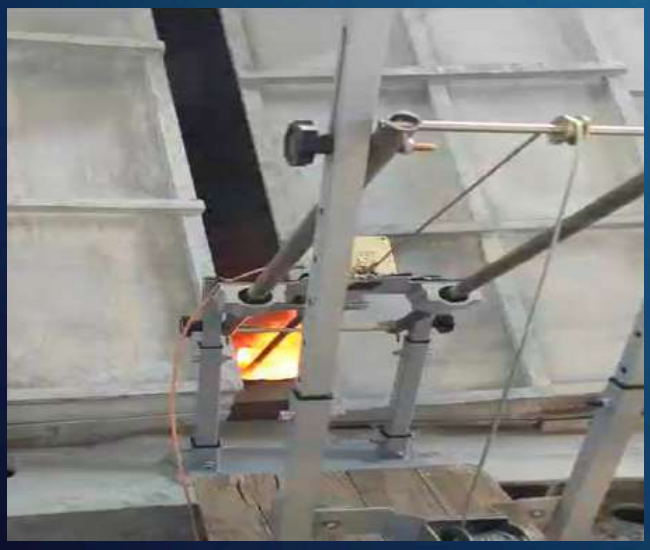
Piezoresistive nanocomposites, such as GNP-doped PMMA, present a complementary approach by enabling conformal, surface-level sensing. SEM analysis reveals flake-like GNPs (~20–50 µm) forming partially interconnected conductive networks within the matrix. These networks are sensitive to mechanical deformation, where changes in inter-particle spacing lead to measurable variations in electrical resistance, enabling effective monitoring of damage evolution.

Recent advances in fiber optic sensing and ultrasonic waveguide technologies at the Centre for Non-Destructive Evaluation (CNDE) further address these limitations by improving both resolution and operational range. Developments such as high-resolution distributed acoustic sensing (DAS) and waveguide-based ultrasonic measurements at temperatures up to 1400 °C significantly expand sensing capabilities.

Together, these approaches point toward next-generation sensing paradigms that combine large-area coverage, high resolution, and enhanced environmental robustness, transforming materials and structures into truly ubiquitous sensing systems.



SEM image of flake-like GNP structures in the nanocomposite sensor



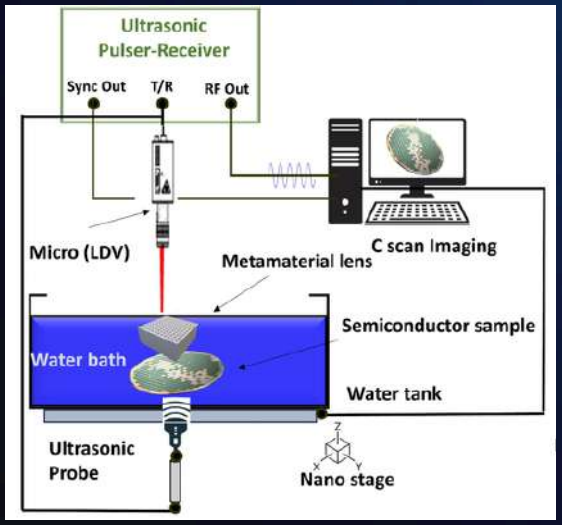
Ultrasonic Waveguide for Molten Metals Cryolite Bath and Measurements up to 1400 °C

Courtesy : XYMA Analytics Pvt Ltd

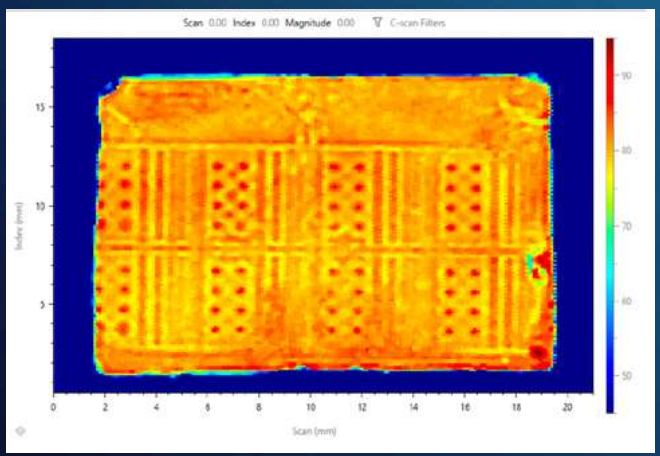
Theme 2: Structured Materials for Imaging Pushing Imaging to Its Physical Limits

NDE 5.0 leverages engineered and structured materials, including metamaterials, to overcome classical resolution limits in ultrasonic imaging. These materials enable enhanced wave manipulation, sub-wavelength focusing, and improved defect sensitivity. Recent demonstrations of ultrasonic super-resolution imaging beyond the diffraction limit, with reported resolutions approaching λ/75 under controlled conditions, highlight the potential of material-assisted imaging for identifying early-stage damage and micro-scale defects that are inaccessible to conventional ultrasonic techniques. In bulk media, however, high-resolution evaluation at greater depths remains a fundamental challenge, particularly for detecting microscopic defects in critical domains such as quantum materials, nuclear systems, aviation, and biomedical applications. While electromagnetic methods like X-ray imaging provide high resolution, they suffer from limited penetration, high cost, and ionizing radiation. Ultrasound offers a cost-effective, non-ionizing alternative with better penetration, but conventional bulk ultrasonics is constrained by the diffraction limit (λ/2), limiting its ability to resolve micron-scale features.

Advanced approaches such as scanning acoustic microscopy improve resolution but are restricted to surface inspection. To address this, metamaterial-based lenses (metalenses) enable recovery of evanescent waves for sub-wavelength imaging. Building on this, CNDE has developed micro-structured holey metalenses combined with sub-micron laser-based detection to achieve ~50 micron resolution at MHz frequencies, enabling deeper, high-resolution inspection beyond conventional limits.



Experimental Setup for Micron-Scale Ultrasonic Characterization



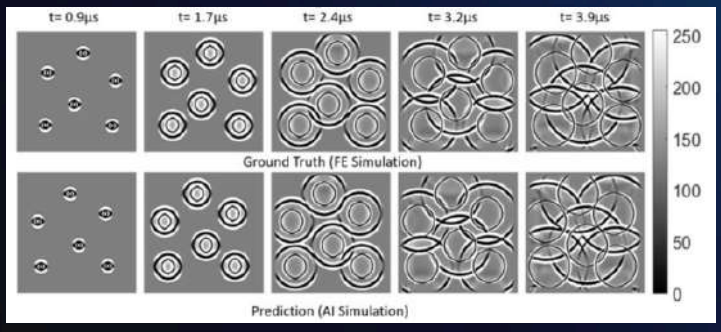
Micro- and Nano- Imaging for Electronics

Theme 3: Edge Intelligence & Soft Sensing Increasing Fidelity of Measurements

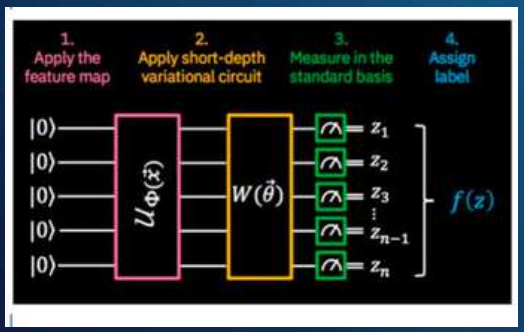
Numerical computational methods such as Finite Element, Finite Difference, Finite Volume, and Boundary Element methods are widely used for solving complex physical problems; however, their high computational cost and resource requirements often restrict them to offline execution. This work proposes a disruptive paradigm that translates these numerical models onto edge computing platforms, including GPUs and TPUs, enabling real-time and resource-efficient computation. Over the past two years, the CNDE group has advanced this approach and demonstrated more than seven orders of magnitude reduction in computational time for problems in wave propagation, phased array ultrasonic testing (PAUT), and infrared thermography, while using significantly lower computational resources.

The core idea involves leveraging numerical simulations to train advanced AI models, which can then perform rapid inference directly at the sensor level, achieving efficient and scalable computation. This framework has already demonstrated up to 1000% extrapolation capability across both 2D and 3D problem domains. Building on this, edge-enabled intelligence is expected to enhance last-mile decision-making by providing real-time analytical capabilities at the sensing stage. Furthermore, physics-based soft sensing approaches are explored to improve data fidelity by augmenting sparse measurements and enabling reliable predictions in inaccessible or harsh environments. This integrated methodology constitutes the Data-driven Simulation-Assisted Physics-Learned AI (DPAI) approach developed at CNDE.

In parallel, CNDE is actively exploring the use of quantum computing for early-stage signal classification, where quantum-enhanced learning models are being investigated to improve feature representation and enable faster, more accurate identification of defect signatures.



Comparison of FE simulation and DPAI prediction



Quantum computing for ultrasonic imaging

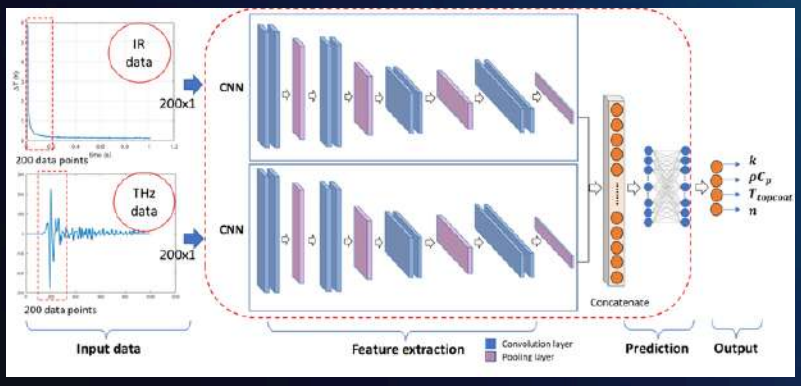
Theme 4: Multi-Modal Inspection Enriching Information Boundaries

NDE 5.0 recognizes that no single inspection modality is sufficient for the reliable assessment of complex materials and structures. Multi-modal inspection integrates complementary techniques such as Digital X-ray, Phased Array Ultrasonic Testing (PAUT), Infrared Thermography (IRT), Acoustics, and Terahertz (THz) imaging and Time Domain Spectroscopy (TDS), supported by advanced data-fusion strategies to enhance information richness and reliability. By combining modalities with different penetration depths, sensitivities, and spatial resolutions, a more comprehensive understanding of defects and material properties can be achieved.

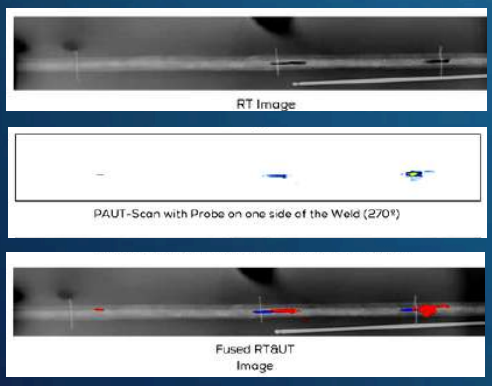
At CNDE, this paradigm has been demonstrated through integrated Digital X-ray and PAUT analysis with automated data fusion, enabling improved defect characterization across multiple spatial scales. Extending this, recent work on Thermal Barrier Coatings (TBCs) integrates IRT and THz TDS, leveraging their complementary strengths in surface sensitivity and subsurface penetration.

To address data scarcity and generalization challenges, CNDE employs simulation-assisted multimodal frameworks that combine physics-based models with experimental data. Advanced deep learning architectures, including attention-based models, enable effective fusion of heterogeneous data with varying spatial and temporal resolutions.

This approach enhances defect detectability, improves property estimation, and reduces uncertainty, enabling more reliable and intelligent inspection systems aligned with the NDE 5.0 vision.



Schematic of the 1D-CNN based framework for the prediction of TBC properties by fusion features from IR and THz data



Multimodal data fusion for weld inspection
Courtesy : Dhvani Analytic Intelligence Pvt Ltd

Theme 5: Remote and Pervasive Inspection Improving Reliability and Safety

NDE 5.0 emphasizes improving safety and reliability through remote and pervasive inspection systems capable of operating in hazardous and inaccessible environments. These approaches significantly reduce human exposure while ensuring consistent, repeatable, and high-quality inspection outcomes. By enabling continuous and real-time monitoring, they also support early detection of defects and improved decision-making for critical assets.

At CNDE, this vision is being realized through the development of integrated remote inspection platforms that combine advanced sensing, edge intelligence, and autonomous operation. Notably, CNDE has developed first-of-its-kind bio-inspired robotic systems and autonomous shop robot, demonstrating seamless integration of sensing, intelligence, and deployment in real-world environments.

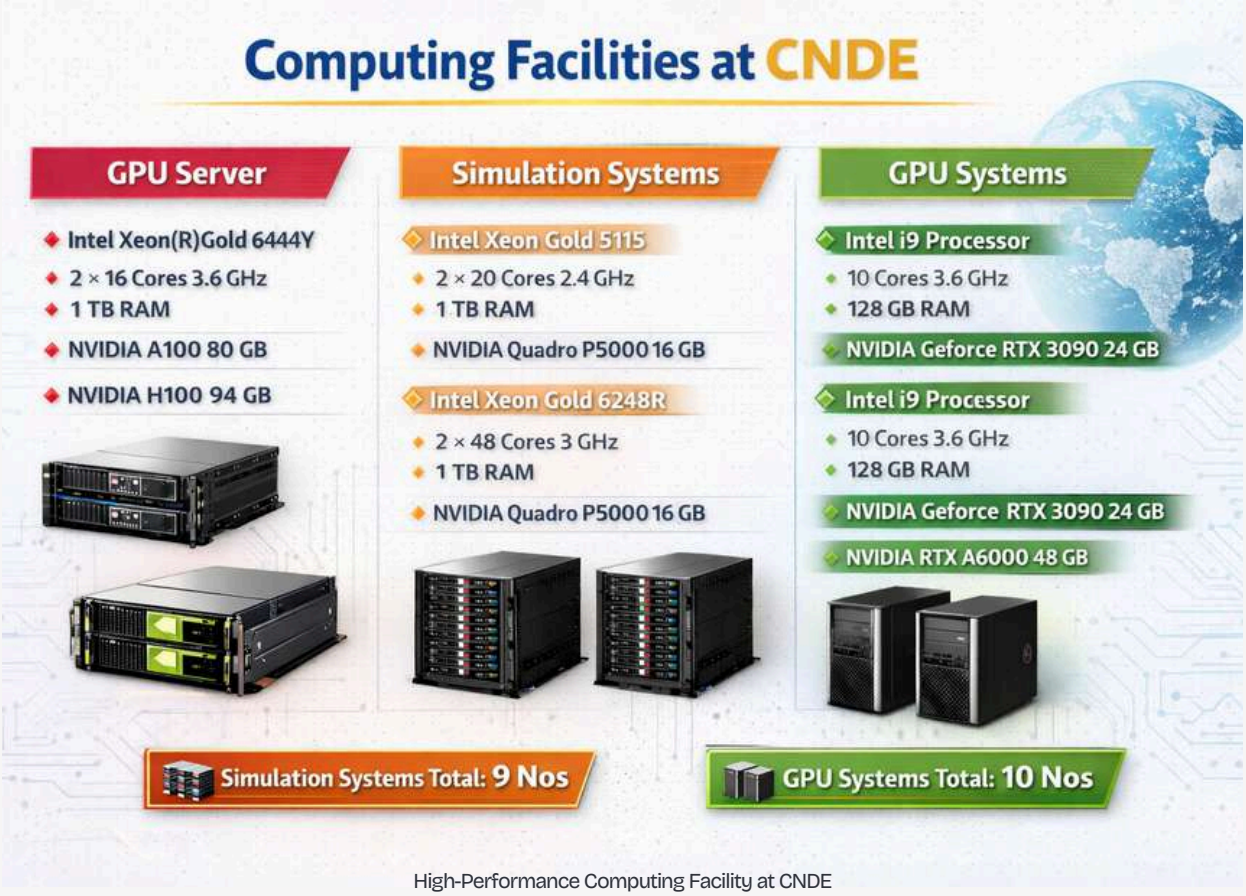
The focus is on creating unified inspection solutions where sensing, intelligence, and deployment capabilities are tightly integrated to deliver reliable and scalable NDE. Such systems enable last-mile inspection and decision-making, ensuring safe, efficient, and human-centric deployment of NDE technologies across diverse applications.

Autonomous Shop Robot developed at CNDE

KEY Infrastructure

Computing Facilities at CNDE

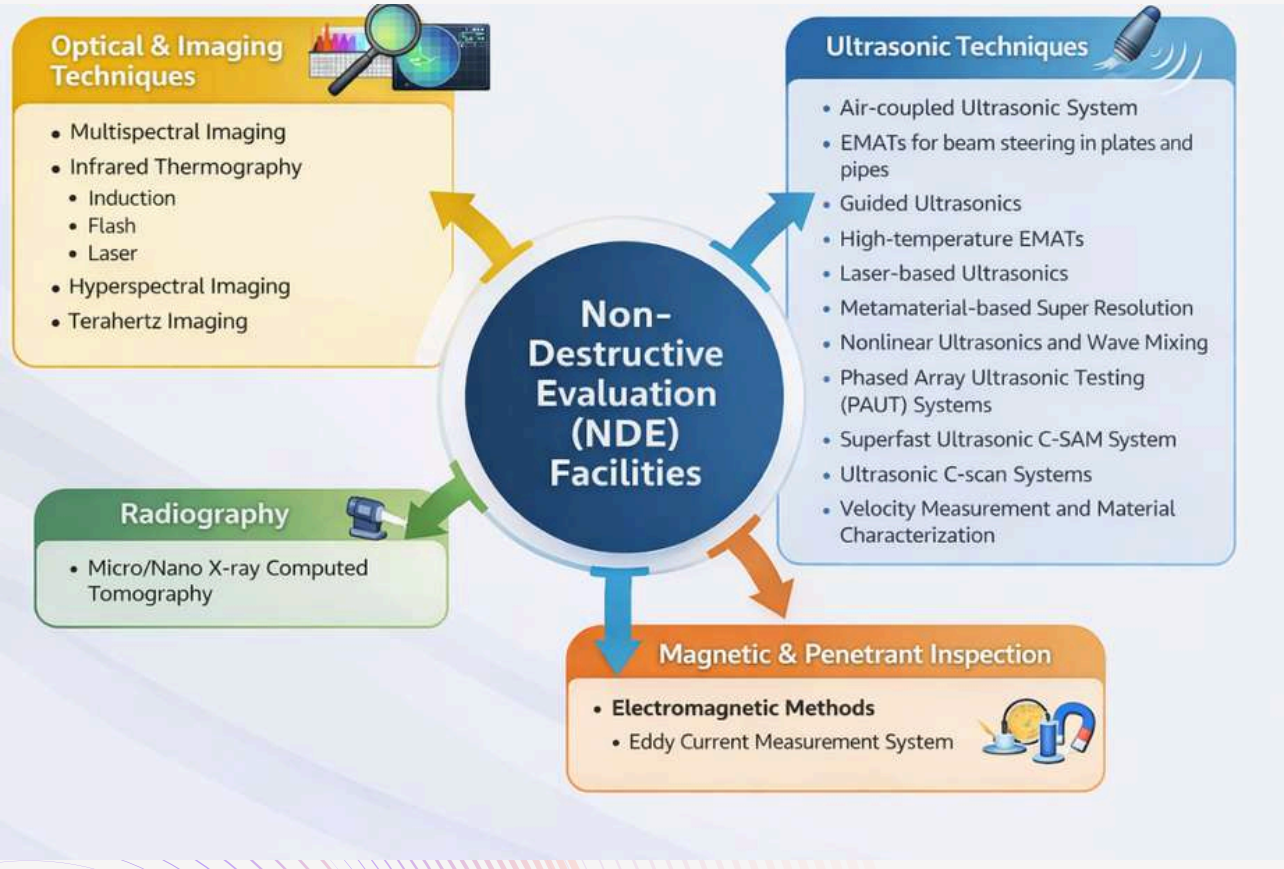
The computational facilities at the Centre for NDE provides a strong foundation for advanced simulation, data processing, and analysis required in modern non-destructive evaluation. The Centre is equipped with high-performance computing (HPC) systems that support large-scale numerical simulations such as finite element modeling of wave propagation, fracture behavior, and multi-physics problems, enabling efficient handling of complex models with fine meshes and time-dependent analyses. Complementing this, dedicated GPU-enabled resources accelerate data-intensive tasks including image reconstruction, image and data processing, and machine learning-based defect characterization, significantly reducing computation time. Together, these capabilities enable seamless integration of simulations with experimental data, supporting faster analysis, improved predictive modeling, and the development of robust, data-driven NDE methodologies.



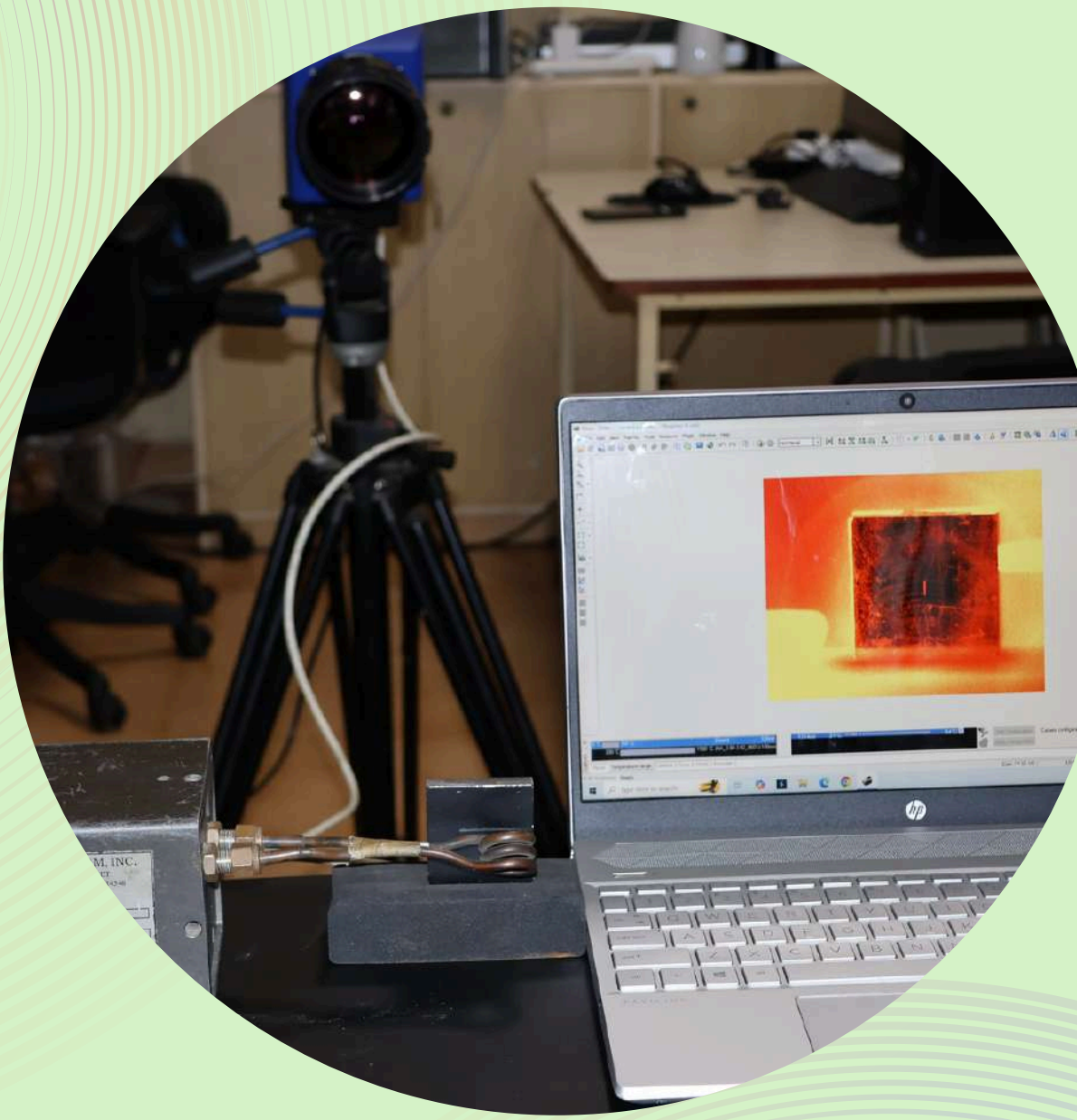
High-Performance Computing Facility at CNDE

Experimental Facilities at CNDE

The Centre for Non-destructive Evaluation (CNDE) at IITM addresses the critical research, development, and training needs of a wide range of national and multinational industries and organizations. Industries involved in infrastructure, aerospace, energy, transportation, medical and archaeology, will significantly benefit from the proposed activities. The Centre for Nondestructive Evaluation (CNDE) focuses on the research and development of new theories and techniques for use in quantitative NDE as well as the dissemination of knowledge in the field of NDE.

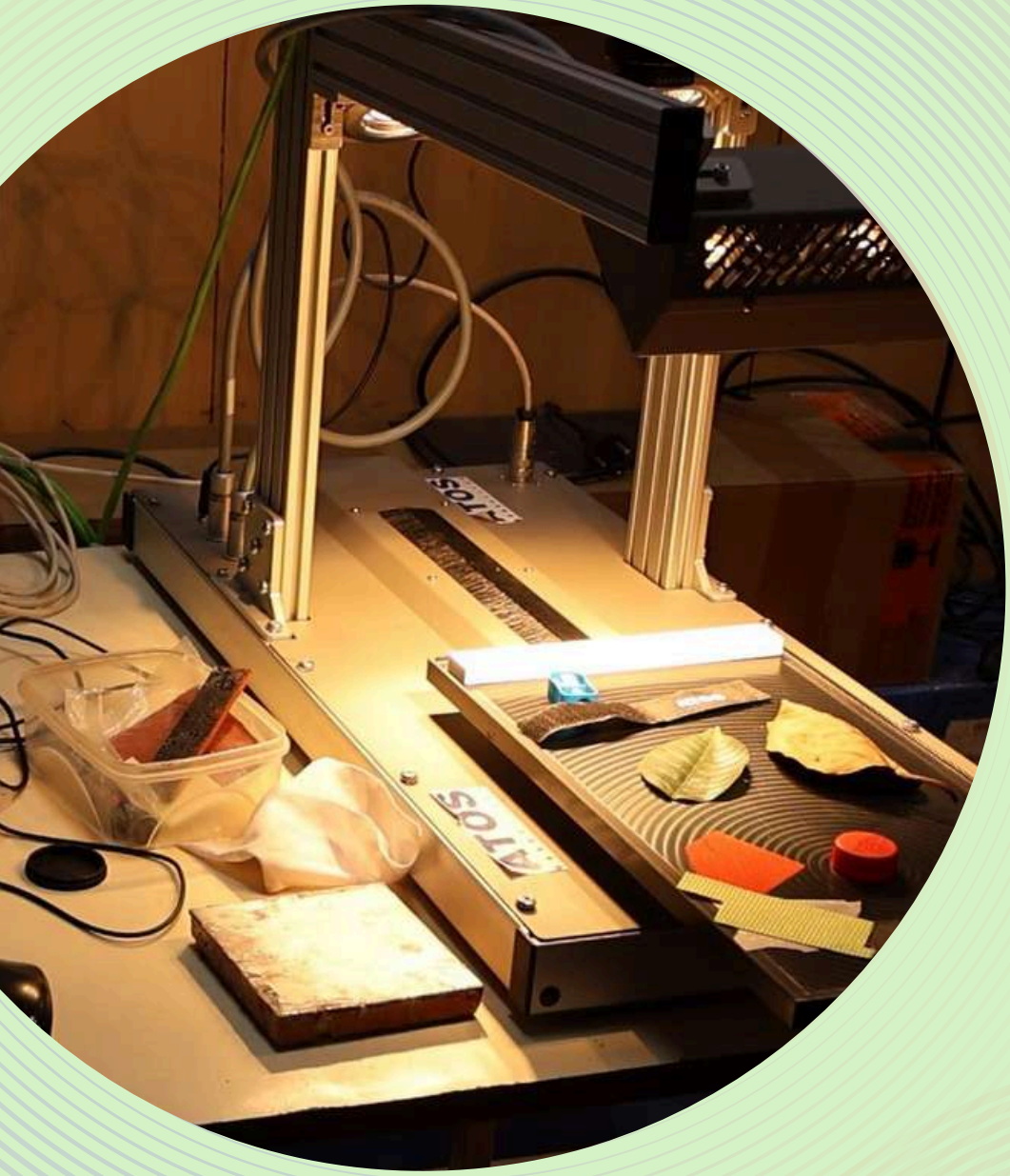


Experimental facilities available at CNDE



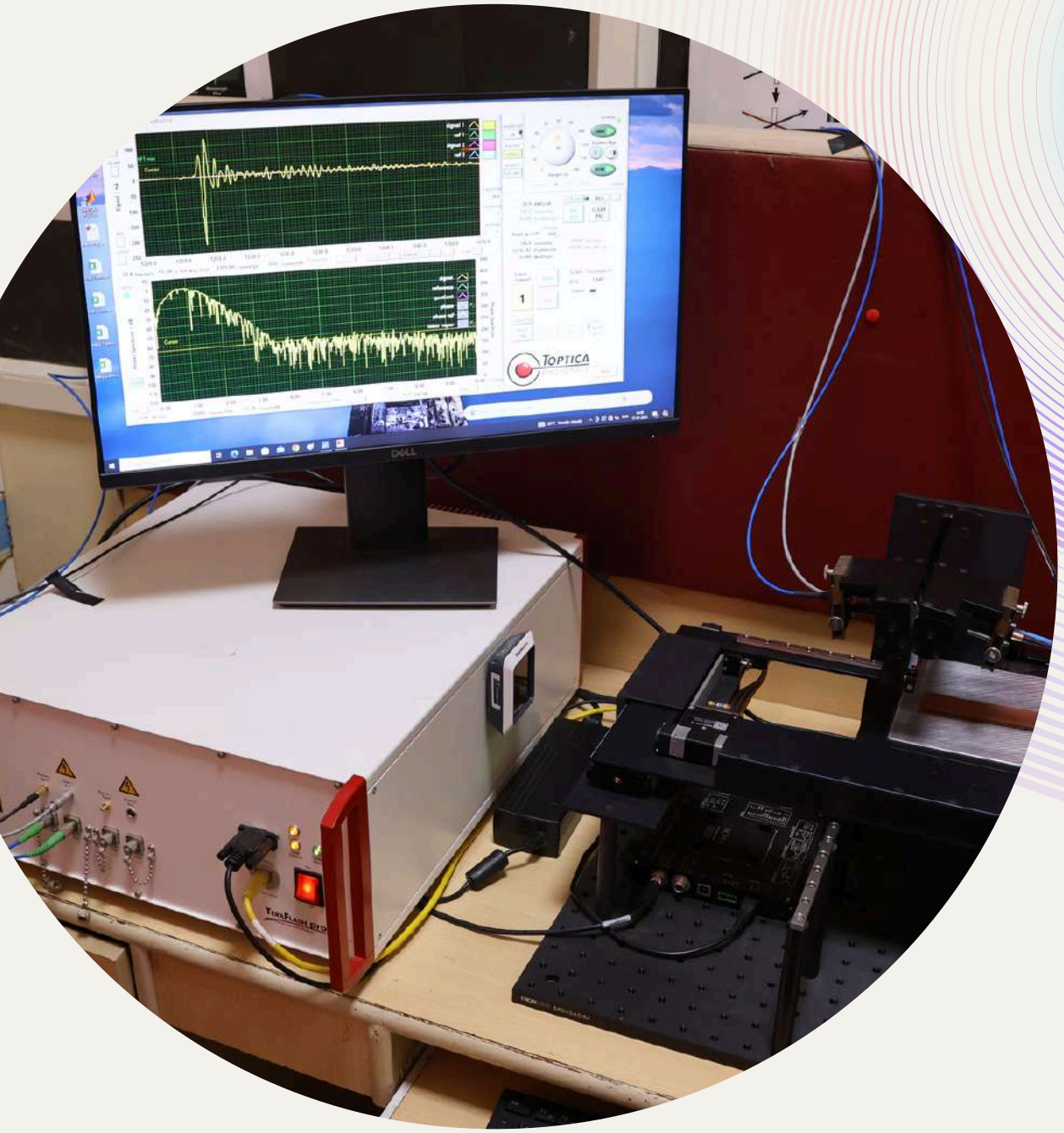
INFRARED(IR) THERMOGRAPHY

Infrared Thermography (IRT) is a non-contact technique used to detect and measure temperature variations on the surface of objects by capturing the infrared radiation they emit. Since all objects above absolute zero emit heat, thermal cameras can convert this radiation into visible images called thermograms. These images display temperature differences using color variations, helping in identifying abnormal heat patterns.



HYPER SPECTRAL IMAGING (HSI)

The Specim FX17 hyperspectral imaging system enhances the Centre for NDE's ability to inspect and characterise materials using a non-contact approach. It operates in the near-infrared (NIR) to short-wave infrared (SWIR) range (approximately 900-1700 nm). This wide spectral range allows the system to capture information not only from the surface but also from beneath it, which is often difficult with conventional imaging methods.



TERAHERTZ TIME DOMAIN SPECTROSCOPY (THz-TDS)

The TeraFlash Pro based Terahertz Time-Domain Spectroscopy (THz-TDS) facility at the Centre for NDE enables non-contact and non-ionizing inspection of materials in the terahertz frequency range. It is well suited for evaluating composites, ceramics, polymers, and layered structures, with the ability to detect subsurface defects such as delaminations, voids, and inclusions. The system also supports thickness measurement and characterization of material properties such as refractive index, absorption, and moisture content.

PHASED ARRAY ULTRASONIC TESTING (PAUT)

The CNDE is equipped with ultrasonic C-scan systems for high-resolution inspection using immersion techniques, with different tank configurations to accommodate both small samples and larger components. These systems provide precise scanning and controlled coupling conditions, enabling detailed mapping of defects, thickness variations, and material inhomogeneities. Additionally, the setups offer the flexibility to integrate air-coupled transducers, extending inspection capabilities to non-contact evaluations where immersion is not feasible.

SCANNING ACOUSTIC MICROSCOPY (C-SAM) AND MICRO-FOCAL LASER

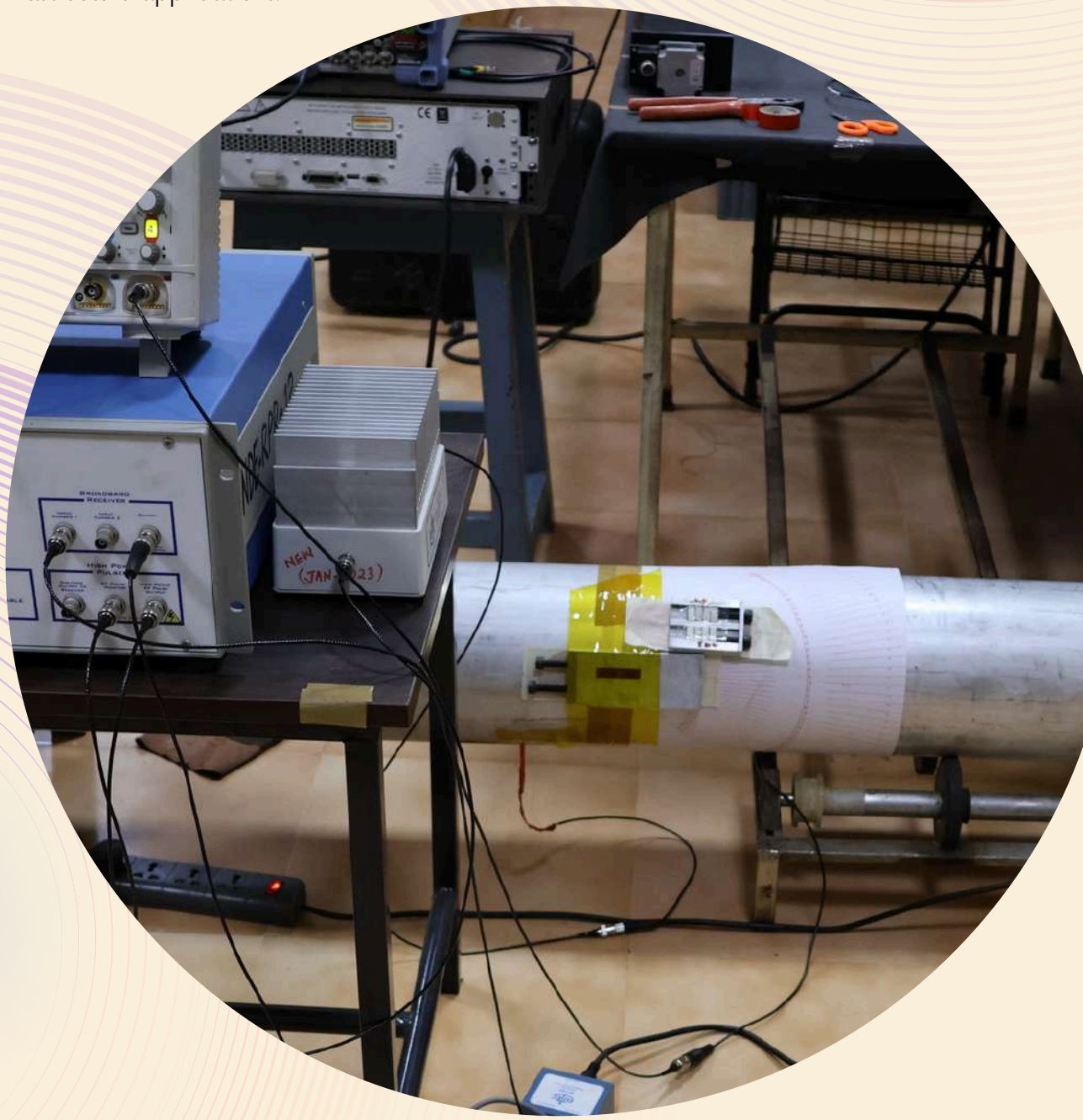
The Centre for NDE houses advanced Scanning Acoustic Microscopy (C-SAM) facilities for high-resolution, micro-scale inspection of materials. C-SAM uses focused ultrasonic waves to detect subsurface defects such as delaminations, voids, and micro-cracks, while enabling detailed layer-wise imaging and thickness evaluation, especially in composites and electronic components.
Complementing this, the Micro-focal Laser system enables highly localised, non-contact excitation and measurement for material characterisation. It supports applications such as surface profiling and wave propagation studies, enhancing the Centre's capabilities in precise, small-scale diagnostics.

ULTRASONIC C-SCAN SYSTEMS

The Centre is equipped with advanced PAUT systems, including the Eddyfi Panther, Eddyfi Gekko, TPAC Explorer, and multi-channel Pilot units, enabling versatile ultrasonic inspection capabilities. These systems support a wide range of excitation and imaging techniques such as electronic scanning, Total Focusing Method (TFM), and sectorial scanning, providing real-time, high-resolution imaging for reliable defect detection. Additionally, the platforms allow acquisition of time-series data that can be further processed in environments like Python or MATLAB, enabling the development of advanced reconstruction algorithms and enhanced signal interpretation.

Helical Guided Wave Generation Using Staggered EMAT in Pipe Structures

The Staggered Electromagnetic Acoustic Transducer (EMAT) uses laterally offset magnet rows to modify Lorentz forces, enabling controlled steering of ultrasonic guided waves in pipe structures. This configuration enables precise adjustment of wave propagation direction to improve inspection coverage. Studies show that beam steering angles of about 14° and 26° can be achieved using Periodic Permanent Magnet (PPM) and Halbach arrangements, respectively, with appropriate offsets. The system also enables the generation of helical guided waves, whose paths can be tracked along the pipe circumference using amplitude analysis. These capabilities make Staggered EMATs highly effective for detecting localised defects in pipelines, particularly in oil and gas and other critical infrastructure applications.



GAIL-IITM Testbed: A Platform for Advanced Pipeline Diagnostics

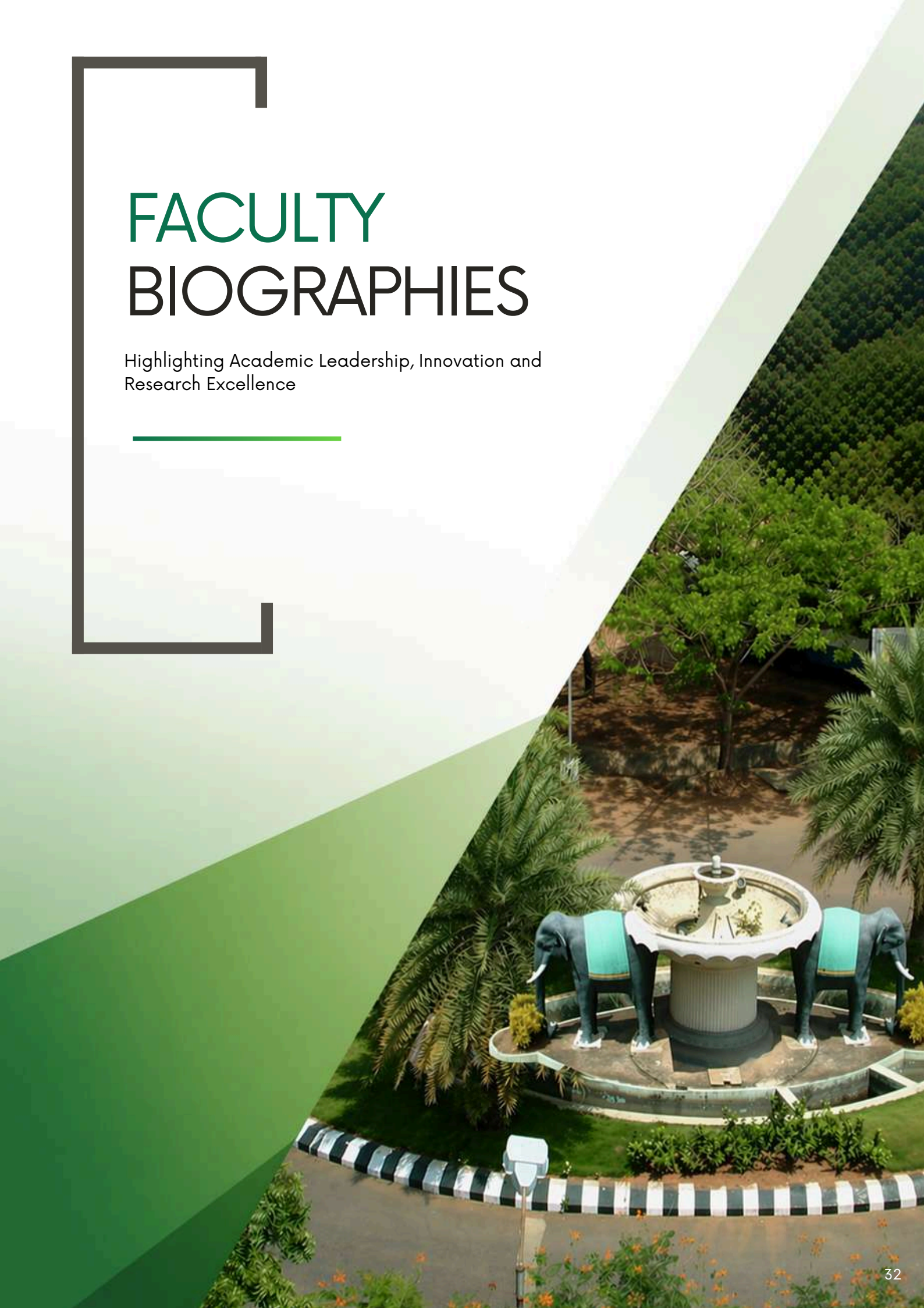
The GAIL-IITM testbed serves as a dedicated experimental facility for studying leak detection, intrusion monitoring and structural health monitoring in buried pipeline systems under controlled conditions. It is designed to replicate realistic field scenarios, enabling the investigation of various leak sizes, locations, and operating pressures. The testbed integrates advanced sensing techniques, including distributed optical fiber sensing, to capture transient thermal and pressure responses. Overall, the facility plays a key role in bridging the gap between laboratory research and real-world pipeline monitoring applications.

Micro and Nano Computed Tomography

The Phoenix x-ray v|tome|x s 240 X-ray computed tomography system enhances the CNDE's capability for high-resolution, non-destructive 3D inspection of materials. Using X-ray attenuation and a microfocus source, it reconstructs volumetric images from multiple projections, enabling the detection of fine features such as micro-cracks, voids, inclusions, and density variations, especially in complex and composite structures.
Aligned with the Centre's focus, the system supports defect characterisation, porosity analysis, dimensional metrology, and evaluation of bonding and internal integrity, along with studies on failure mechanisms and manufacturing defects. It has been applied to areas such as inspection of 3D-printed components, ceramics, metals, and encapsulated systems, as well as validation of simulation models. Additionally, its quantitative 3D data complements techniques like hyperspectral imaging by providing structural insights alongside compositional information.

FACULTY BIOGRAPHIES

Highlighting Academic Leadership, Innovation and Research Excellence



Prof.Krishnan Balasubramanian
Institute Professor
"Class of 81" Chair Professor
Prof. in Charge of Gopalakrishnan Deshpande Center for Innovation & Entrepreneurship
Prof. in Charge of Accenture CoE for Product X
Prof. in Charge of Center for Advanced Automotive Research (CAAR)
Head of Centre for Nondestructive Evaluation

Prof. Krishnan Balasubramaniam is an Institute Professor in the Department of Mechanical Engineering at IIT Madras and heads the Centre for Non-Destructive Evaluation (CNDE). He previously served as Dean, Industrial Consultancy & Sponsored Research (ICSR) and has been the visionary leader behind the Gopalakrishnan-Deshpande Centre for Innovation & Entrepreneurship (GDC) since 2017. Through his leadership, he has successfully bridged academia, industry, and entrepreneurship, translating research innovations into impactful real-world technologies and startups. He received his B.E. from the University of Madras (1984) and M.S. (1986) and Ph.D. (1989) from Drexel University, USA. Over the past three decades, Prof. Balasubramaniam has been at the forefront of research and innovation in non-destructive evaluation (NDE), ultrasonics, structural health monitoring, and advanced sensing technologies. His contributions include pioneering work in laser-ultrasonics for in-situ viscosity and temperature measurement of molten metals, hybrid finite-element and genetic-algorithm approaches for composite material characterization and guided-wave sensor arrays for continuous monitoring of critical infrastructure.

He has authored over 200 peer-reviewed publications, with an H-index of 36, and has led more than 30 major funded research projects exceeding ₹50 crore. His work has significantly influenced applications in aerospace, energy, infrastructure, water systems, and healthcare, contributing to improved safety and reliability of pipelines, pressure vessels, bridges, and medical devices. Prof. Balasubramaniam is also an accomplished innovator, holding 17 patents. He serves as Editor-in-Chief of the Journal of Non-Destructive Testing & Evaluation and Associate Editor for Ultrasonics and NDT&E International, contributing actively to shaping global NDE research. He is also Vice President of the Indian Society for Non-Destructive Testing (ISNT) and a Fellow of the Indian National Academy of Engineering (INAE) and Academia NDT International. In recognition of his outstanding contributions to science and engineering, he was elected Fellow of the Indian Academy of Sciences (IAS) in 2025. Prof. Balasubramaniam has received numerous honors including the Abdul Kalam National Technology Innovation Fellowship (2018), DRDO Academic Excellence Award (2015), and the Roy Sharpe Prize (2012) from the British Institute of Non-Destructive Testing. He has also served on several national advisory bodies, including DST's Nano Mission and Rural Technology Business Incubator initiatives.

Prof. Prabhu Rajagopal, FNAE
Director-in-Charge, IITM Zanzibar,
Dy Head, CoE on NDE 5.0, Core Faculty of School of I&E, Mukta Pai Fellow, Nanjangud G Viswanath Swabhanu Leadership Chair Professor IIT Madras
Chairman, Plenome Technologies Pvt. Ltd

With PhD and Post-doc from Imperial College London and 5-year Integrated Masters from IIT Madras, Prof. Prabhu Rajagopal has expertise in automation and data engineering. His original contributions in Nondestructive Evaluation, robotics and data management have yielded 113 publications in peer-reviewed journals, 150+ other technical articles and 55+ granted IPs, attracting R&D + venture funding > S 50mn. His work on super-resolution ultrasonics down to quantum scale is widely recognised, receiving Young Scientist Awards from Indian Society for NDT (2016), Institute for Smart Structures and Systems (2017) and the prestigious Swarnajayanti Fellowship (2020). Prof. Rajagopal has international collaborations with leading academic and industrial partners in UK, EU and East Africa in particular. He has co-founded startups including Planys (submersible robots), Solinas (robotics for water/sanitation) and Xyma (high temperature ultrasonic sensors), that are disrupting asset maintenance (contributing to elimination of manual scavenging for e.g.., through Solinas). His work on population-scale AI for regulated data environments is commerialised by Plenome; BotForge, Automagri, Matterize, Terraclime, Satori and Xen advance AI for robotics and farm, industrial and manufacturing automation. Prof. Rajagopal played key roles in India's I&E ecosystem, leading IITM's maker-space Center for Innovation (2020-25), pre-incubator Nirmaan (2023-25) and founding the School of I&E, while serving on the Board of TECHIN the Startup Incubator of IIT Palakkad (since 2023). He is recipient of the National Design Award (2016), Gandhian Young Technology Award (2018), National Entrepreneurship and Startup Awards (2019-20 - Planys), Economic Times Startup Award (2022- Solinas), IITM Institute R&D Award (2019 & 2025) and National Technology Award (2023 - Xyma). In recognition of his pioneering translational research, he was recipient of India's highest award for mid-career scientists, the Bhatnagar prize (2024), and inducted as a Honorary Fellow of the Indian Society for NDT (2024), Mukta Pai Faculty Fellow (2025), and fellow of the Indian National Academy of Engineering (2025). Currently the Nanjangud G. Viswanath Swabhanu Leadership Chair Professor at IITM, he leads the insitute's first offshore campus in Zanzibar Tanzania as its 2nd Director-in-charge. He is also Adjunct Professor at University of Nairobi, serves as Technical Advisor to the Network of Entrepreneurial Institutions Leaders, and Vice Chair of Working Group 3: Eduaction and Research at the International Committee for NDT.

Prof. Balaji Srinivasan
Electrical Engineering
DST-IITM Pravartak Senior Faculty
Advisor, Internships & Placements, BS Degree in Data Sciences
IIT Madras.

Dr. Balaji Srinivasan, a distinguished professor in the Department of Electrical Engineering and an integral member of the Center for Non-Destructive Evaluation (CNDE), IIT Madras, has made remarkable contributions to academia and industry alike. With over 28 high-impact research projects worth ₹2,000 crores under his leadership, he has driven advancements in critical areas such as distributed sensing systems, high-power fiber lasers, and structural health monitoring. His notable projects include DRDO-funded underwater laser communications, pipeline monitoring using Distributed Acoustic Sensing (DAS) in collaboration with GAIL, and fiber optic current sensors that enhance precision in electrical systems. Dr. Balaji Srinivasan's innovations extend beyond research labs, delivering real-world impact across industries. His Optical Time Domain Reflectometer (OTDR) has been deployed by Telecom Malaysia, while Fiber Bragg Grating Sensors are utilized for structural monitoring by organizations like BHEL and IGCAR. He has also developed multi-kW pulsed fiber lasers for defense applications, which have been commercialized by Unilu men Photonics, and underground vibration detection systems revolutionizing security for BEL.

A prolific academic, Dr. Balaji Srinivasan has authored 71 journal papers, delivered 42 invited talks, presented at 155 conferences, and holds 25 patents. His teaching portfolio includes 17 unique courses such as Fiber Lasers and Applications and Introduction to Photonics, while his mentorship has guided 18 M.S. and 10 Ph.D. scholars, with 9 more currently under his tutelage. Recognized for his excellence, he has received accolades such as the Rajamani Award (2021), the Collegiate Inventor Award (2000), and Senior Membership in the Optical Society of America. Through global collaborations with institutions like the University of Southampton and EPFL, and national partnerships with DRDO, IISc, and IGCAR, Dr. Balaji Srinivasan continues to address critical challenges in energy, infrastructure, and national security. His vision and dedication not only strengthen India's technological leadership in photonics and fiber optics but also inspire the next generation to illuminate the path of innovation.

Prof. Manu Santhanam
Professor, Department of Civil Engineering, IIT Madras

Dr. Manu Santhanam is a professor in the Building Technology and Construction Management division, Department of Civil Engineering and currently Dean for Industrial Consultancy and Sponsored Research (ICSR), IIT Madras. He completed his Bachelor Degree in Civil Engineering from IIT Madras in 1994. He joined Purdue University for Master's program to explore wider research opportunities. Professor Manu joined Sika Corporation, USA as Senior R&D Chemist in May 1996 and served for more than 2 years. Later, he pursued his doctoral research from Purdue University, USA. He joined back his alma mater, Purdue University, as an instructor in May 2001 for short period. In October 2001, he joined IIT Madras as Assistant Professor in the BTCM division of the Department of Civil Engineering. He became Associate Professor on March 2009 and was promoted as Professor on July 2013. He teaches undergraduate and graduate-level courses mainly in the areas of construction materials, concrete technology, non-destructive testing and characterization of construction materials. His research domains cover cement chemistry and multi-scale characterization of concrete including non-destructive testing, assessment of deterioration mechanisms in concrete and masonry structures, 3D printing of concrete structures, concrete durability and use of supplementary cementing materials. He is also a part of the National Centre for Safety of Heritage Structures (NCSHS) in IITM which focuses on scientific methods for conservation of heritage structures. He is actively involved in several research projects funded by government and private agencies on the design, durability studies and development of performance specification for high performance and self-compacting concrete. He has co-authored more than 70+ international journal publications, 30+ national journal publications and about 70 conference papers on construction material properties and performance. His contributions extend to several book chapters which he co-authored with national and international researchers. He is also active in various professional associations such as ACI, ICI, and RILEM and has been distinguished as a RILEM fellow in 2019. He is also a member of Editorial Board in leading international journal on construction materials such as Advances in Cement Research, ASCE Journal of Materials in Civil Engineering (Associate Editor), Journal of Sustainable Cement-Based Materials and Journal of Cement and Concrete Composites.

Prof. Kavitha Arunachalam
Professor, Department of Engineering Design
IIT Madras

Prof. Kavitha Arunachalam is a faculty member at the Centre for Non-Destructive Evaluation (CNDE), Indian Institute of Technology Madras (IIT Madras). She is actively engaged in research and academic activities in the domain of Non-Destructive Evaluation (NDE), with a strong focus on advanced inspection techniques, materials characterization, and structural integrity assessment. Her research interests include ultrasonic testing, signal processing for defect detection, advanced NDE methodologies, and the application of innovative diagnostic tools for ensuring safety and reliability in engineering systems. She has contributed significantly to the development and refinement of inspection techniques aimed at improving accuracy, reliability, and industrial applicability.

Professor Kavitha has been involved in multiple collaborative research projects with industry and research organizations, strengthening academia–industry interaction in the field of NDE. She is also deeply committed to teaching and mentoring students at undergraduate, postgraduate, and doctoral levels, guiding research scholars in cutting-edge areas of materials evaluation and structural health monitoring.

Through her academic leadership and research contributions, she continues to play an important role in advancing the mission of CNDE in research excellence, technological innovation, and human resource development in non-destructive evaluation.

Prof. Abhishek Saini
Assistant Professor, Department of
Mechanical Engineering, IIT Madras

Dr. Abhishek Saini is an Assistant Professor in the Department of Mechanical Engineering at the Indian Institute of Technology Madras and is affiliated with the Center for Non-Destructive Evaluation (CNDE). He received his Ph.D. from Nanyang Technological University, Singapore. Prior to joining IIT Madras, he worked as a Senior Data Scientist at Razer (Asia-Pacific) Pte. Ltd. He has also held postdoctoral research positions at Los Alamos National Laboratory, USA and the Rolls-Royce@NTU Corporate Laboratory Singapore, where his work focused on the intersection of advanced sensing, physics-based modeling, and data-driven technologies.

Dr. Saini's research integrates ultrasonic phased array techniques, wave physics, advanced imaging and inversion, ultrasound tomography, metamaterials, signal processing, and applied artificial intelligence to develop next-generation solutions for Non-Destructive Evaluation (NDE) and Structural Health Monitoring (SHM). His work spans fundamental theoretical developments to deployable industrial technologies, addressing critical challenges in defect and material characterization, predictive maintenance, high-resolution imaging, and the digital transformation of inspection systems.

Prof. Vivek Samu
Assistant Professor, Department of Civil Engineering
IIT Madras

Dr. Vivek Samu is an Assistant Professor in the Department of Civil Engineering at IIT Madras. He received his B.Tech. from National Institute of Technology Tiruchirappalli and his M.S. and Ph.D. from North Carolina State University, USA. Dr. Samu's research broadly addresses the non-destructive evaluation (NDE) of civil infrastructure through wave propagation-based methodologies. His work focusses on advancing existing NDE techniques and developing new, simplified approaches for quality assurance and condition monitoring of infrastructure systems, through efficient computational modelling, optimal sensing, automation, and inversion techniques.

His current research spans several applications such as pile integrity evaluation for deep foundation assessment, non-destructive characterization of asphalt and concrete pavements, ultrasonic tomography for the imaging and condition assessment of concrete structures, and the development of innovative geogrid geometries grounded in tiling theory.

Prof. Tarun Naskar,
Associate Professor,Department of Civil Engineering
IIT Madras

Dr. Tarun Naskar is an Associate Professor in the Department of Civil Engineering at IIT Madras, specialising in geotechnical engineering with a focus on non-destructive characterisation of soils, elastic wavefield modelling, seismic signal processing, and distributed acoustic sensing. He obtained his PhD in Civil Engineering (Geotechnical Engineering) from the Indian Institute of Science in 2018. His research primarily focuses on surface wave–based non-destructive site characterisation methods (SASW/MASW), wavefield transformation techniques, inversion of dispersion curves, DAS-based infrastructure monitoring, and the integration of machine learning for subsurface profiling. He has made significant contributions to analytical and semi-analytical modelling of wave propagation in layered media, high-resolution dispersion imaging, and efficient inversion frameworks for shear wave velocity estimation.

Dr. Naskar has published 19+ refereed journal papers in leading international journals such as Géotechnique, Geophysics, Soil Dynamics and Earthquake Engineering, Geophysical Journal International, etc. He is a Corresponding Member of ISSMGE TC105 (Geo-mechanics) and actively collaborates on interdisciplinary projects involving seismic hazard analysis, site response studies, and geo-energy applications. He has supervised multiple Ph.D., M.S., and M.Tech students at IIT Madras and teaches core and elective courses including Advanced Soil Mechanics, Dynamics of Soils and Foundations, Experimental Geotechnics, and Geotechnical Engineering.

Prof. S. Ramaprabhu
Emeritus Professor, Department of Physics, IIT Madras

Prof. S. Ramaprabhu specializes in nanoscience and nanotechnology, with research focused on carbon nanomaterials, energy systems, and environmental applications. His work includes hydrogen energy, batteries, supercapacitors, and materials for sensing and energy harvesting.

He has published extensively, holds multiple patents, and has supervised over 50 doctoral scholars. His contributions have been recognized through international fellowships, including the Alexander von Humboldt Fellowship.

Prof. Tiju Thomas
Professor, Department of Metallurgical and Materials Engineering, IIT Madras

Prof. Tiju Thomas specializes in materials science and nanotechnology, focusing on the design, synthesis, and application of advanced functional materials. His work includes nanostructured materials, device materials, and systems for energy storage and sustainable technologies.
He has authored over 200 publications and received recognitions such as the INSPIRE Faculty Award and the DST Fast Track Young Scientist Award. His research contributes to energy, environmental monitoring, and advanced material applications.

Prof. C. V. Krishnamurthy
Associate Professor, Department of Physics, IIT Madras

Prof. C. V. Krishnamurthy specializes in applied and computational physics, focusing on wave propagation, ultrasonics, and NDE. His research includes electromagnetic, acoustic, and elastic wave modelling, with applications in material characterization and diagnostics.

He also works on metamaterials, impedance spectroscopy, and advanced sensing techniques, contributing to both fundamental research and engineering applications.

NATIONAL CONSORTIUM FOR **NON-DESTRUCTIVE EVALUATION (NCNDE)**

Advancing Collaborative research, Innovation and national capability in Non-Destructive Evaluation

Chief Executive Officer

Mr. Venugopal Manoharan

Venugopal Manoharan is the Chief Executive Officer of the Center for Nondestructive Evaluation (CNDE) at the Indian Institute of Technology Madras, where he leads programs in advanced inspection science, translational NDE, and workforce development, external collaborations and National Consortium for NDE. Over a career spanning 35+ years, he has worked across the full spectrum of NDE—fundamental research, system design, standards and regulation, and high-value industrial deployment.

Before CNDE, he was Principal Technologist at VisiConsult X-ray Systems & Solutions, focusing on digital radiography (DR), computed tomography (CT), and radiological safety/regulation. He previously spent 19 years as a Senior Scientist at GE Research, and earlier served as Scientific Officer at BARC (Advanced Fuel Fabrication Facility) and in IGCAR's Division of Post-Irradiation Examination and NDT Development.

Manoharan is an ISNT National NDT Award recipient and an ISNT Fellow (2023). He holds ASNT Level III certifications in RT, IR, UT, PT, and ET. His technical interests include industrial radiography and radiation safety, digital X-ray imaging, modeling & simulation, quantitative radiography and model-based Probability of Detection (PoD), applications of micro/nano X-ray CT, pipeline and pressure-vessel integrity, and professional training in NDE. He is an inventor on 12+ patents and has 30 publications in national and international venues. Since January 2022, he has served as Chief Controller of Examinations for the National Certification Board (ISNT) and as PFMB Chair for the past two years.

Mr. Srinivasan Chittahur

Mr. Srinivasan Chittahur has over 35 years of experience in inspection of pressure vessels, heavy equipment, and piping systems across manufacturing and hydrocarbon industries.
He has led shutdown inspections across Gulf countries and brings expertise in NDT, heat treatment, risk-based inspection, and failure analysis. He holds ASNT Level III certification and multiple API qualifications, with extensive experience in refinery and petrochemical inspections.

Dr. Kannan Chandrasekaran

Dr. Kannan Chandrasekaran is an expert in materials engineering, corrosion science, and NDE, with over 30 years of experience in the oil and gas sector.
A former Executive Director at Indian Oil Corporation, he has led initiatives in pipeline integrity, corrosion management, and advanced inspection technologies. He has authored 200+ publications and holds multiple patents in materials and NDE.

Dr. Shyamsunder Mandayam

Dr. Shyamsunder Mandayam is a seasoned NDE expert with over 40 years of experience across aerospace, defence, oil & gas, and nuclear sectors.
He has held leadership roles at IGCAR and GE Research, contributing to advanced inspection technologies including digital radiography, ultrasonics, and emerging NDE 4.0 systems. He holds multiple patents, has over 220 publications, and has received prestigious awards including the ISNT National NDT Award.

Mr. Anil Kumar Das

Mr. Anil Kumar Das is a power sector expert with over 30 years of experience in NDE, materials engineering, and asset integrity. A former Chief General Manager at NTPC NETRA, he has led key R&D initiatives in power plant reliability and safety.
He has conducted 600+ life assessment studies and specializes in advanced inspection techniques such as PAUT, eddy current, and magnetic methods. He is an ASNT Level III expert and has contributed through patents, publications, and leadership roles in ISNT.

Mr. B. Venkatraman

B. Venkatraman is a distinguished nuclear scientist and former Director of Indira Gandhi Centre for Atomic Research, with over 39 years of experience in India's Department of Atomic Energy. He specializes in NDE, radiation safety, and quality assurance, and has pioneered advanced imaging techniques such as neutron radiography and infrared thermography. He has led major national programs in nuclear technology and established key NDE facilities, contributing significantly to India's scientific and engineering advancements.

Mr. Prem Kumar

Mr. Prem Kumar is a mechanical engineering professional with over 35 years of experience in the oil & gas refinery sector, specializing in asset integrity, maintenance, and project engineering.He has extensive expertise in failure analysis, corrosion control, and risk-based inspection, and has led large-scale refinery turnarounds to improve reliability and operational performance.
He contributes to bridging academia and industry through CNDE initiatives, supporting collaborative solutions for real-world industrial challenges.

Mr. D Suresh

Suresh D has been with CNDE since 2016 and currently serves as a Senior Project Engineer. He holds a B.Tech in Electronics and Communication Engineering, along with a Diploma in ECE and an ITI in Diesel Mechanic—bringing a strong blend of electronics and mechanical expertise.He has led the development of advanced robotic inspection systems for major NDT projects at CNDE, collaborating with NTPC, IOCL, and Honeywell. Key highlights include NTPC boiler water wall inspection robots with live LabVIEW data acquisition, silicon wafer inspection systems, and reformer tube inspection robots (IND-RoPRINT). These systems integrate laser-based OD measurement, 360-degree ultrasonic testing using roller probes, IMU-based profiling, and encoder-based position tracking.

In his role, he leads mechanical design and integrated control system development, including motor controllers, sensor interfaces, power systems, and safety features within Pelican-based setups. He also coordinates laboratory programs, training sessions, and exhibitions, ensuring smooth execution while supporting multidisciplinary project activities across electrical, mechanical, and electronics domains.

Mr. G Dinesh Kumar

I am Dinesh Kumar G, and I joined the CNDE department in 2015. I have over 11 years of experience in developing advanced robotic inspection systems, with a strong focus on design and programming.I played a key role in the Ind-RoPRIT (Roller Probe Based Reformer Inspection Tool) project, developed in collaboration with IOCL R&D. This tool is used to detect internal damages, bulging, and OD variations in reformer tubes at IOCL plants. The project has been successfully completed and patented jointly by CNDE and IOCL.

I have also provided programming and technical support for railway track inspection systems in collaboration with the RailLab startup team. In addition, I have contributed to robotic inspection projects for NTPC, including Scopei and other robotic systems, working on both design and programming aspects.

Mr. S Santhosh Sriram

Santhosh Sriram S has been with CNDE since 2023 and serves as a key contributor to its digital transformation initiatives. He leads the development of software platforms supporting CNDE operations and startups such as TIQWorld.
Guided by Prof. Krishnan Balasubramanian, he is actively driving the development of Inspection-as-a-Service (IaaS) and agent-based intelligent systems, enabling scalable, data-driven inspection solutions. His role involves shaping system architecture, aligning technology with operational goals, and fostering innovation in digital inspection workflows.He also supports CNDE's media and digital ecosystem, ensuring effective communication, platform reliability, and integration across initiatives.

Mr. S Sudar

Sudar S serves as a Senior Software Developer at the Centre for Non-Destructive Evaluation (CNDE), contributing to both technological development and organizational initiatives. He holds a Bachelor of Computer Applications (BCA) and a Master of Business Administration (MBA), combining technical expertise with strong management insight. His key areas of interest include Artificial Intelligence and Machine Learning, along with management-driven technology solutions.
At CNDE, Sudar has played a key role in developing the official CNDE website along with his team, strengthening the institute's digital presence. He has also contributed to building web applications for startups such as TiqWorld and Folium Sensing, supporting innovation within the CNDE ecosystem. In addition, he serves as a key coordinator for various events and training programs conducted by CNDE, ensuring their successful execution. Through his work, he actively bridges technology, startups, and institutional development.

ADMIN TEAM

Mr. G Prabakaran

G. Prabakaran has been with CNDE since 2009 and manages the high-performance computing infrastructure at the CNDE lab, ensuring reliable and efficient operation for student learning and research activities. He is responsible for system maintenance, hardware management, and secure network administration, enabling seamless access to computing resources.
In addition, he oversees data backup and system security protocols while providing continuous technical support to faculty, researchers, and students. His role is critical in maintaining a stable and high-performing IT environment that supports advanced research and day-to-day operations at CNDE.

Mrs. R Dhanalakshmi

Dhanalakshmi R has been serving as Executive Secretary at CNDE since 2021, supporting administrative operations and leadership coordination. She manages executive schedules, communications, and documentation.
She contributes to efficient office processes and inter-department coordination, ensuring smooth day-to-day operations. Known for her professionalism, attention to detail, and reliability, she effectively handles time-sensitive tasks and supports the leadership team.

Mr. K Kirubanandhan

Kirubanandhan K serves as a Junior Lab Technician at CNDE since 2023, supporting laboratory operations and daily technical activities. He is involved in media handling and inventory management, ensuring proper maintenance, tracking, and availability of equipment and resources. He assists in organizing lab materials, coordinating logistics for projects and events, and maintaining an efficient workflow within the lab environment. His role contributes to the smooth functioning of laboratory activities and effective resource management at CNDE.

Researchers

DRIVING INNOVATION.
ADVANCING DISCOVERY.

Dr. Arsath Abbasali Ayubali

Dr. Arsath's research this year has advanced through the successful development and on-ground implementation of the GAIL Pipeline Integrity Monitoring Testbed at IIT Madras Discovery Campus at Thaiyur. Building on his doctoral expertise in the creep–fatigue behavior of high-temperature materials, he now contributes to the deployment, and evaluation of a full-scale buried pipeline test facility integrating Distributed Acoustic Sensing (DAS) and Distributed Temperature Sensing (DTS) technologies.

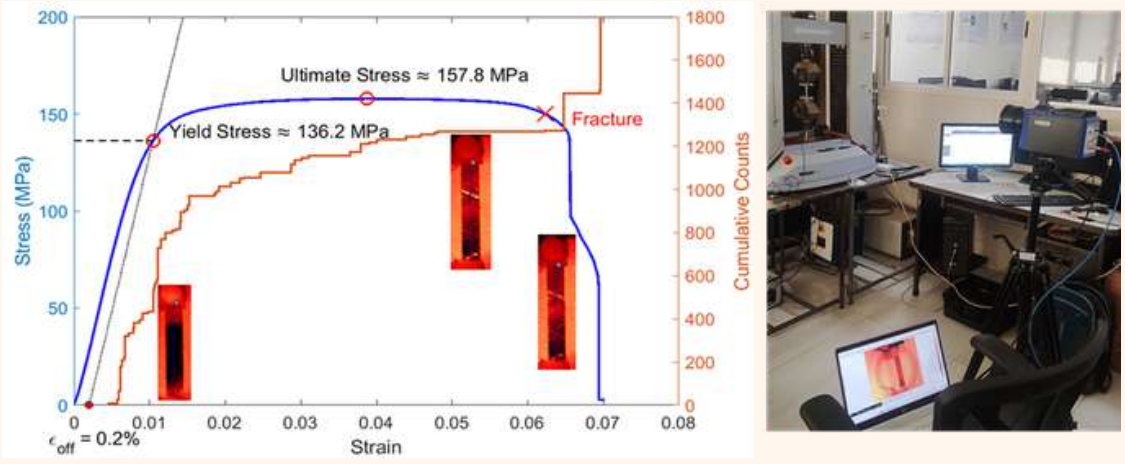
His work spans testbed construction, field instrumentation, and advanced computational modelling. He has overseen the installation of fiber-optic sensing pathways, leak-generation modules, control valves, and data acquisition infrastructure, ensuring seamless coupling between hardware, sensing systems, and cloud-based analytics. These efforts are supported by extensive CFD and multiphysics simulations that capture gas leak dynamics, soil–pipeline interactions, and sensor response behavior under realistic operating conditions. By combining field experiments and numerical simulations, Dr. Arsath is working toward the development of intelligent and scalable leak-detection frameworks for oil and gas infrastructure.

GAIL Pipeline Integrity monitoring testbed, Leak pit with leak actuation setup for different position and different leak diameter and pipeline pigging monitoring.

Dr. Krishnadas V K

Dr. Krishnadas V K hails from Ernakulam, Kerala, and completed his PhD at the CNDE, IIT Madras, under the supervision of Prof. Krishnan Balasubramaniam. His doctoral research focused on nonlinear ultrasonic (NLU) wave propagation in plates and cylindrical structures. He discovered a novel second-harmonic component in these geometries that exhibits enhanced sensitivity to microstructural degradation capabilities not observed in conventional fundamental or existing second-harmonic wave modes. During his PhD, he also collaborated on several interdisciplinary projects, including the use of EMATs for guided wave generation and use of acoustic metamaterials for harmonic filtering to improve ultrasonic defect detection.

As a postdoctoral fellow, he is broadening his expertise across a spectrum of NDE techniques, such as Acoustic Emission, Infrared Thermography, Terahertz Imaging, Hyperspectral imaging, X-ray Radiography, and Computed Tomography, reflecting a strong inclination toward cross-disciplinary research. One of his notable industry-linked contributions involves the combined use of Acoustic Emission and IR Thermography to capture crack initiation and growth in thin samples under static and dynamic loading.



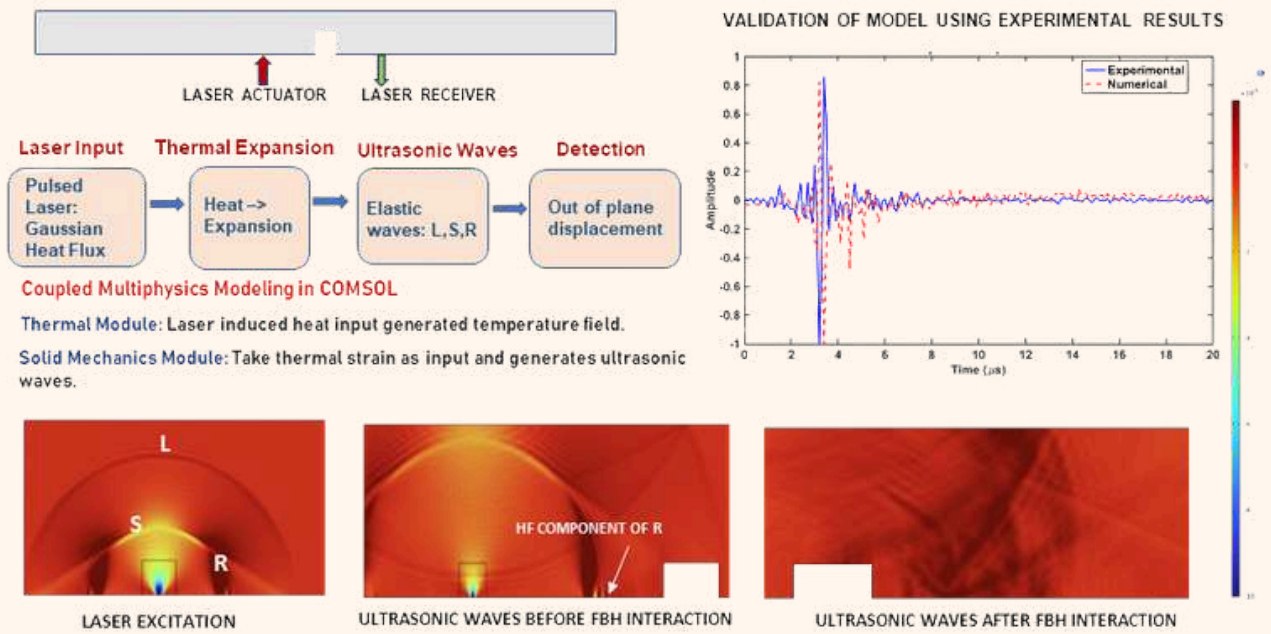
Stress vs strain plot overlaid with cumulative AE count and Infrared thermography images at different stages of sample fracture upon static uniaxial tensile loading

Dr. Udita Pant

Dr. Udita specializes in SHM and advanced NDT techniques. After completing her MTech from IIT Roorkee, she earned her PhD (PMRF) at IIT Bombay, where she developed ultrasonic methods for detecting debonding in FRP-strengthened concrete. At CNDE, she is expanding her work into laser ultrasonics, infrared thermography, and terahertz imaging.

Her current research focuses on laser-based ultrasonic inspection in thermoelastic and ablative regimes, coupling transient heat transfer with elastic wave propagation for high-resolution defect characterization.

Her team integrates numerical modeling with experimental studies to analyze laser-induced wave behavior, optimize key laser parameters, and enhance defect detectability. This work aims to develop robust, non-contact inspection techniques, while enabling reliable defect sizing and supporting real-time, in-line monitoring for aerospace, nuclear, and automotive applications

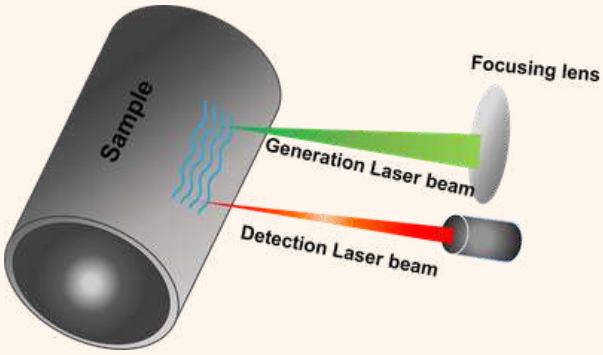


Laser Ultrasonics for Non-contact Defect Detection

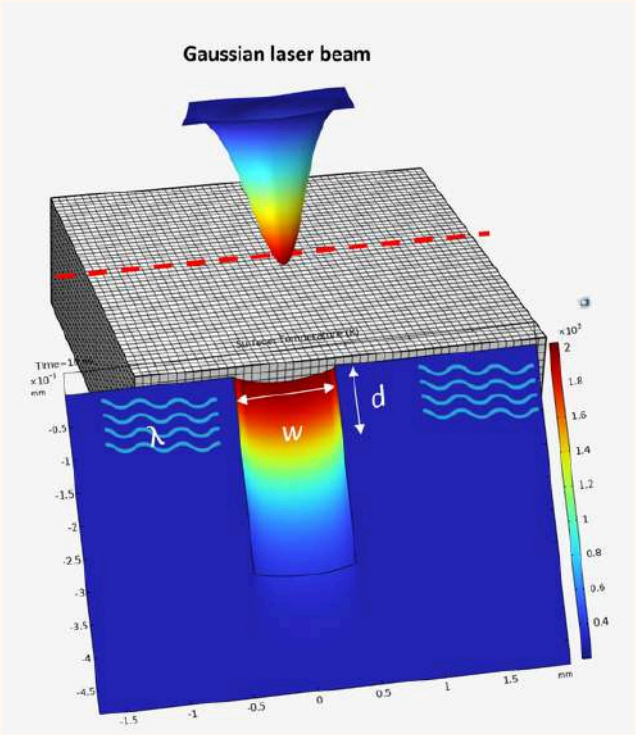
Dr. Sooraj Shiby

Dr. Sooraj completed his integrated MS-PhD at the Indian Institute of Technology Madras in the Opto-Mechatronics Laboratory, where his research focused on pulsed laser-based micro-scribing of copper from dielectric substrates for functional devices fabrication. He subsequently pursued postdoctoral research at IIT Indore and KU Leuven, Belgium, where he worked on laser-matter interaction and laser-induced graphene formation on polymers. Upon returning to IIT Madras, he now contributes to the CNDE, advancing the CNDE's expertise in laser-based ultrasonics and thermography.

His work bridges optics and NDE, establishing an exciting interdisciplinary research direction. The primary advantage of laser-based ultrasonic inspection lies in its non-contact nature, which enables the evaluation of inaccessible regions using fibre-delivered laser systems. Currently, his team is working on quality monitoring of electron-beam welds in titanium alloys. Complementary COMSOL-Multiphysics based FEM simulations are performed to analyze temperature evolution, possibility of surface damage via laser ablation, and ultrasonic wave propagation under varying laser parameters.



Schematic of laser ultrasonics-based NDE

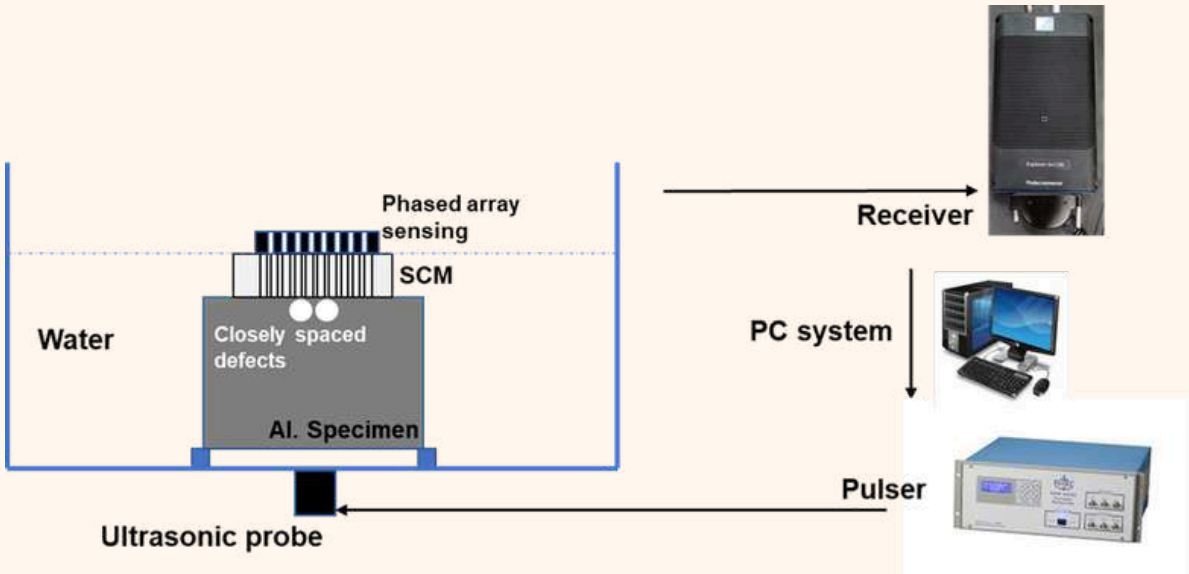


Simulation of laser ablation and ultrasound generation

Dr. Aurovinda Kumar Mitra

Dr. Aurovinda earned his doctorate at IIT Roorkee, where he focused on guided wave–based evaluation of tapered honeycomb sandwich composites in helicopter rotor blades. His work emphasized debond localization and wavenumber analysis in aerospace structures. At CNDE, his current projects include C-scan imaging of micron-scale defects in silicon-based meta-lenses and SH-mode guided wave generation using EMAT, bridging aerospace composites with emerging photonic applications.

He is presently investigating the characterization of closely spaced circular defects in an aluminum specimen using metamaterial-assisted ultrasonic testing. His team aims to achieve subwavelength defect resolution through B-scan imaging enabled by Structured Channel Metalenses (SCM), supported by coordinated experimental and numerical studies. By integrating SCMs with narrow-band array probes, the group has demonstrated the capability to resolve features as small as one-tenth of the acoustic wavelength, representing a significant advancement toward high-resolution, low-cost, and portable ultrasonic imaging systems for industrial and biomedical NDE applications.



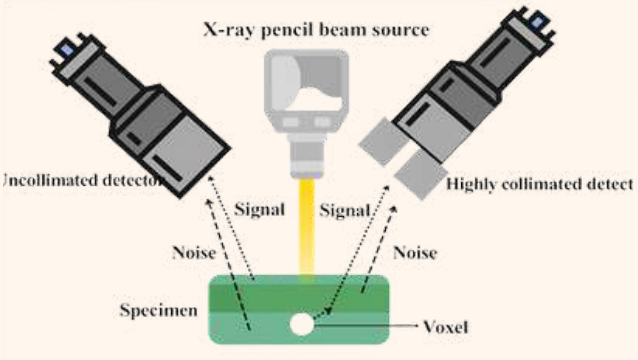
Schematic of the experimental setup used to demonstrate sub-wavelength ultrasonic imaging facilitated by a metalens.

Dr. Rini P L

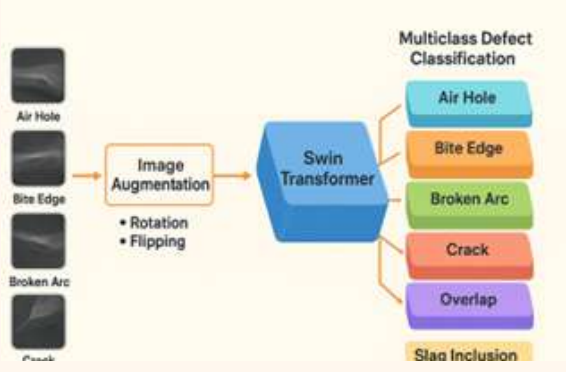
With a doctoral background in Artificial Intelligence (AI) from Anna University, Dr. Rini brings a strong interdisciplinary perspective to the field of NDE. Her doctoral research focused on multimodal behavioral analytics for the early diagnosis of dementia, where she integrated audio, visual, and cognitive data using advanced AI models to improve early-stage detection. This foundation in multimodal learning now informs her ability to handle complex, high-dimensional data in engineering applications.

At the CNDE, her work centers on the fusion of AI with advanced imaging techniques, particularly in Compton backscattering imaging. She applies AI methods to enhance image reconstruction, noise reduction, feature extraction, and defect interpretation, enabling more accurate and reliable inspection outcomes. Her research demonstrates how AI-driven analysis can significantly improve the efficiency and precision of NDE systems, especially in challenging inspection scenarios.

A key focus of her current work is the automation of NDT processes through AI-driven frameworks and the development of simulation-integrated tools. By combining physics-based simulation approaches with surrogate modeling and deep learning architectures, she is building systems that can generate synthetic datasets, predict imaging outputs from input parameters, and automate the end-to-end inspection pipeline. This integration of AI and simulation is paving the way for intelligent, scalable, and data-driven NDE solutions, transforming traditional inspection practices into advanced digital and autonomous systems.



CBI- Radiography by Selective Detection



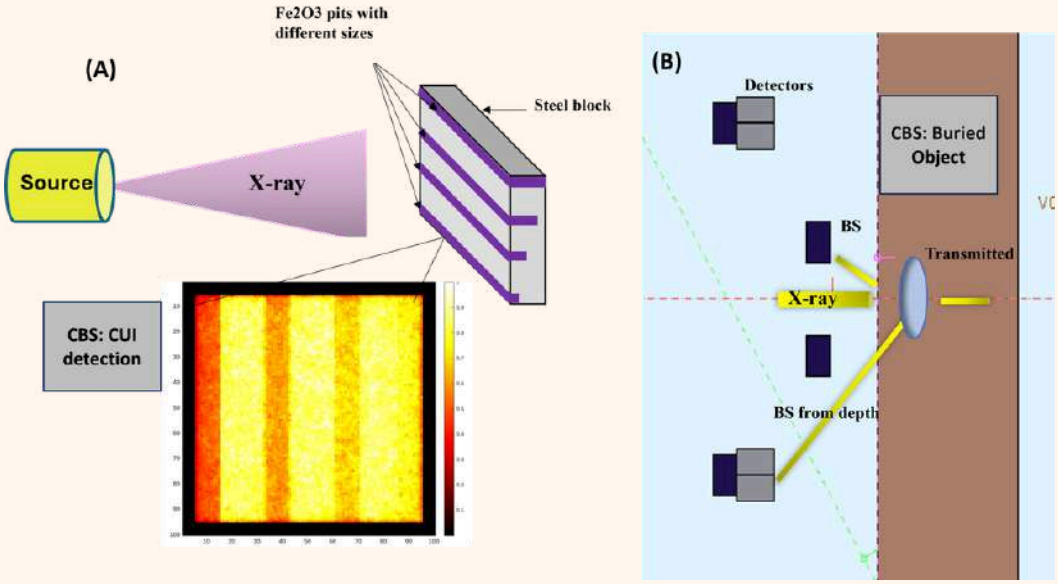
Workflow for weld-defect multiclass classification

Dr. Divya Pandya

Dr. Divya Pandya completed her PhD from Pandit Deendayal Energy University (PDEU), Gandhinagar, Gujarat. During her doctoral research, she was part of a BRNS-funded project titled "3D Printing of Organic–Inorganic Composite Scintillation Detectors." His work focused on the fabrication of scintillators capable of detecting alpha, beta, gamma, and X-ray radiations. He also collaborated with Bhabha Atomic Research Centre (BARC) for advanced testing and characterization. Additionally, he explored transmission-based X-ray imaging using 3D-printed scintillating films.

In November 2025, he joined the CNDE, Indian Institute of Technology Madras, where his research focuses on Compton Backscattering (CBS)–based imaging techniques. CBS is a non-destructive imaging approach that utilizes the energy and angular distribution of backscattered photons resulting from Compton interactions. Unlike conventional transmission imaging, CBS enables single-sided inspection, making it particularly useful in scenarios with limited access or high attenuation. The contrast in CBS imaging is primarily governed by electron density, allowing effective identification of subsurface features and material variations.

The potential applications of CBS imaging span multiple domains, including:
Corrosion Under Insulation (CUI): Detection of hidden degradation in industrial pipelines
Buried Object Detection (defense applications): Identification of concealed objects using single-sided access
Archaeology: Non-invasive exploration of subsurface artifacts
Security Screening: Detection of hidden or inaccessible objects in critical environments

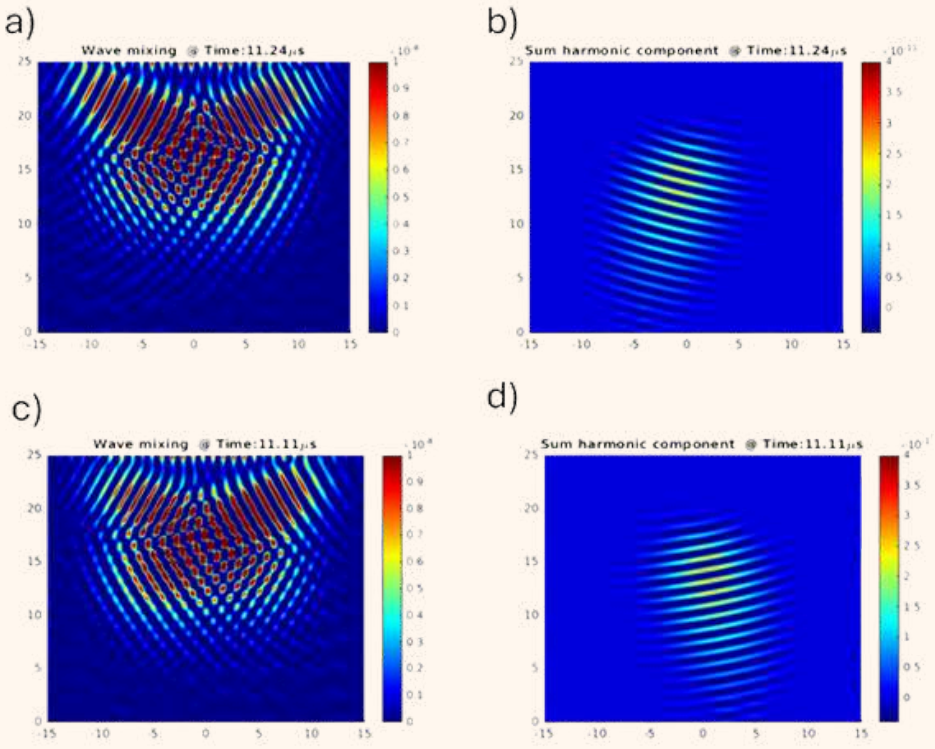


Representation of a Compton backscattering (A) CUI, (B) Buried object detection

Akhil B S

Akhil Balachandran is a PhD Researcher at the CNDE, working under the supervision of Prof. Krishnan Balasubramaniam since 2016. They hold an MTech in NDT from NIT Trichy, where their dissertation focused on Laser Ultrasonic inspection. Their research career in CNDE has been multifaceted, spanning several key areas in NDE. This has included the development of a robotic crawler for thickness monitoring of water wall panels and a novel air-coupled ultrasonic methodology to measure the thickness of falling water film over cooling tower tubes.

Their primary doctoral research specialisation investigates the application of nonlinear ultrasonics for structural integrity. This work has progressed from assessing thin adhesive specimens using third harmonics of fundamental shear horizontal (SH0) modes to their current focus: developing a bulk nonlinear, non-collinear wave mixing technique via immersion ultrasonics to assess the quality of thick adhesive-bonded samples.

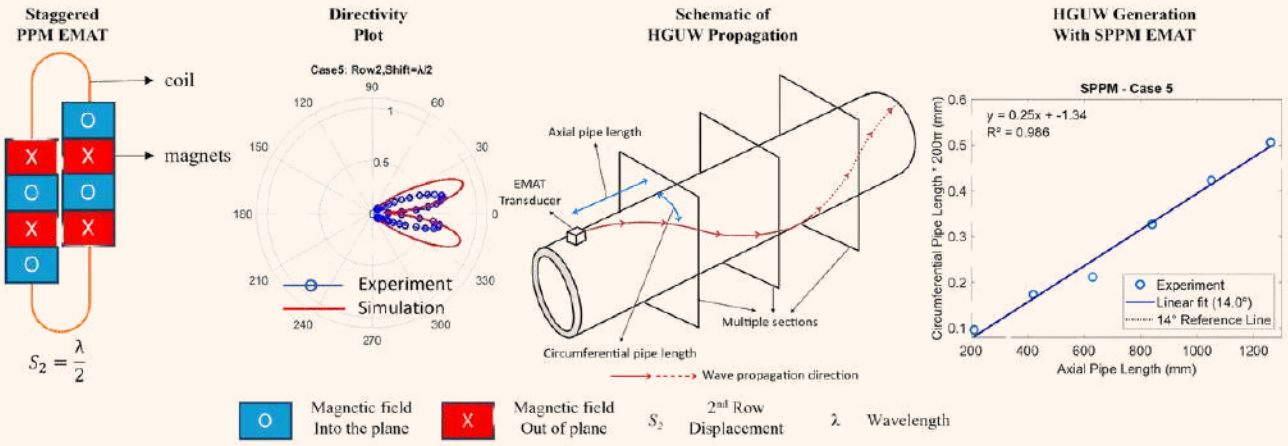


Wave propagation visualisation from a finite element model demonstrating nonlinear wave mixing and sum harmonic generation in an aluminium sample. Subplots (a) and (b) show the primary wave mixing and the resulting sum harmonics for a frequency ratio of 0.75, respectively. Subplots (c) and (d) illustrate the same phenomena for a frequency ratio of 1.25. These visualisations highlight the potential of wave mixing for assessing material nonlinearity.

Pranaydeep Garewal

Pranaydeep Garewal is a Ph.D. research scholar in the CNDE Lab, working under the supervision of Prof. Krishnan Balasubramanian since 2021. He completed his Master's degree from the National Institute of Technology (NIT) Raipur, where his research was focused on biomechanics. In his doctoral research, Pranay is working on the design, development, and optimization of Electromagnetic Acoustic Transducers (EMATs) for advanced non-destructive inspection. His primary thesis involves developing EMAT systems capable of generating helical guided waves for the inspection of large pipelines, with the goal of accurately evaluating remnant wall thickness in corroded regions.

Additionally, he has contributed to developing EMAT suitable for high-temperature environments, focusing on enhancing transducer reliability and sensitivity under extreme operational conditions. His work aims to enable more efficient and reliable structural health monitoring solutions for industrial applications.



Numerical and Simulation Results of Helical Guided Wave Generation with Staggered EMAT

Loheshwaran Chandran

Loheshwaran Chandran is a Joint Ph.D. research scholar in Mechanical Engineering under the IIT Madras – NTU Singapore Joint Doctoral Programme. He works at the Centre for CNDE, IIT Madras, under the supervision of Prof. Prabhu Rajagopal. He completed his M.Tech in Mechanical System Design from IIITDM–Chennai in 2021 and holds a B.E. in Mechanical Engineering from Easwari Engineering College, Chennai.

His doctoral research focuses on developing next-generation ultrasonic imaging techniques using metamaterials to achieve resolutions beyond the conventional diffraction limit. As part of his work, he investigates how sub-wavelength defects behave inside materials and develops micron-scale metalens systems capable of super-resolution imaging. His combined numerical and experimental efforts aim to make high-resolution ultrasonic inspection more practical for industrial and biomedical applications.

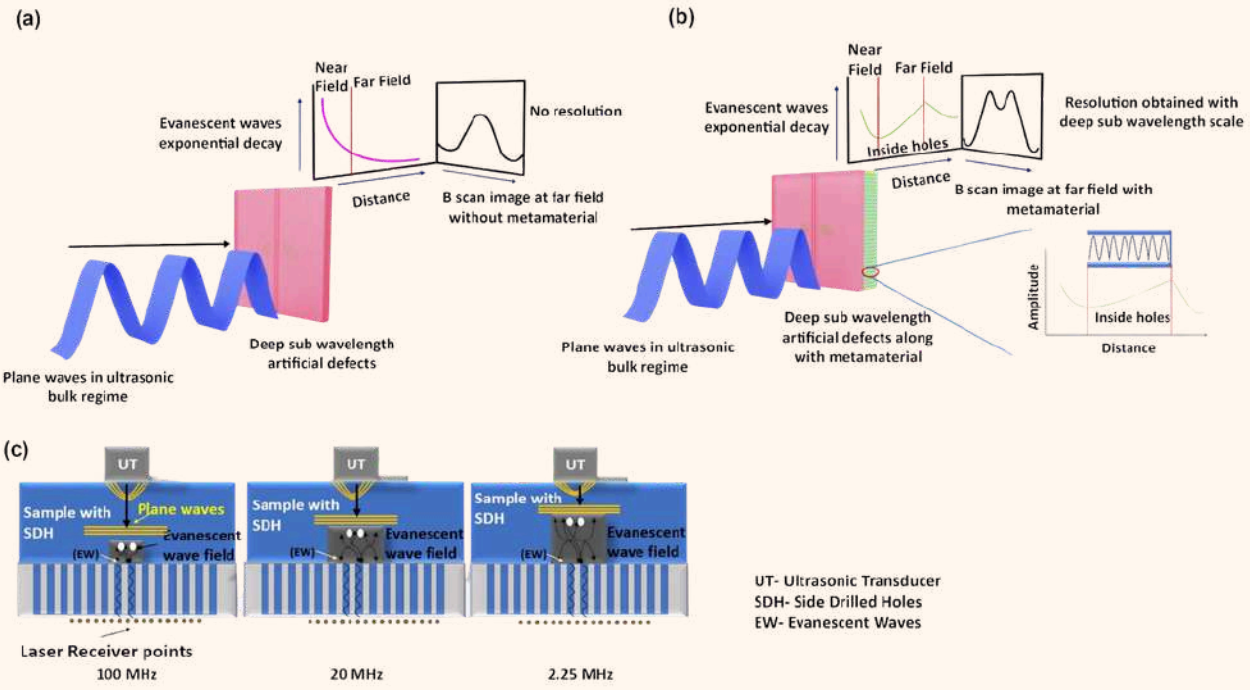


Illustration for super resolution ultrasonic Imaging

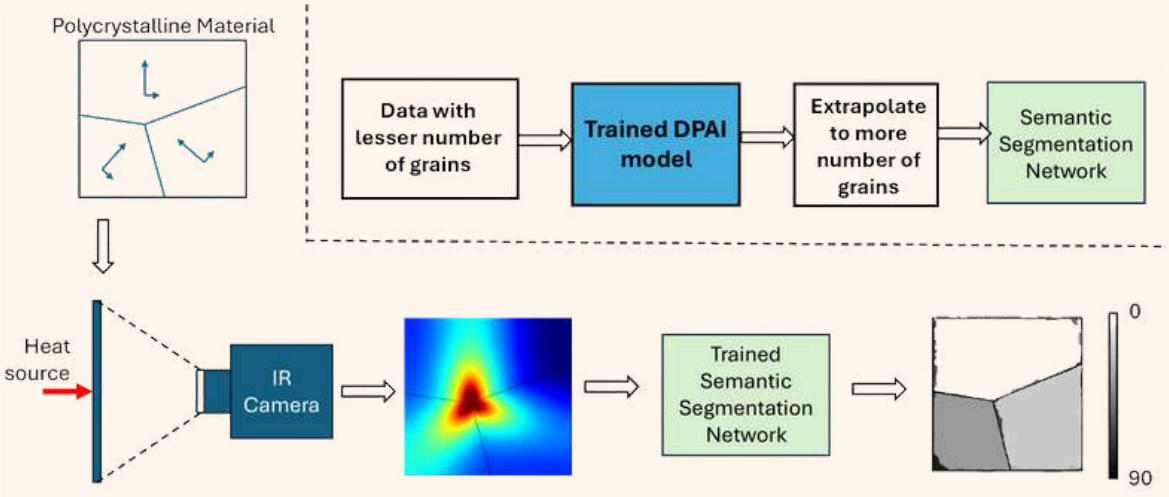
Nishi Sivaraman

Mrs. Nishi Sivaraman is an M.S. and Ph.D. scholar at the CNDE Lab, IIT Madras, working under the supervision of Prof. Krishnan Balasubramanian since 2021. She completed her B.Tech in Mechanical Engineering from Mumbai University, where she worked on the design of a carbon-fiber monocoque structure.

Her doctoral research focuses on studying microstructure and predicting grain orientation using Infrared Thermography (IRT). The isotherms obtained by heating polycrystalline materials are nonlinear and exhibit unique thermal patterns that vary with grain orientation. By analyzing these thermal signatures, it becomes possible to infer the underlying grain orientations

She employs advanced deep-learning techniques to enable faster and more accurate interpretation of thermal images. To experimentally validate her findings, she uses carbon-fiber laminates to replicate grain structures and create exaggerated models for controlled testing.

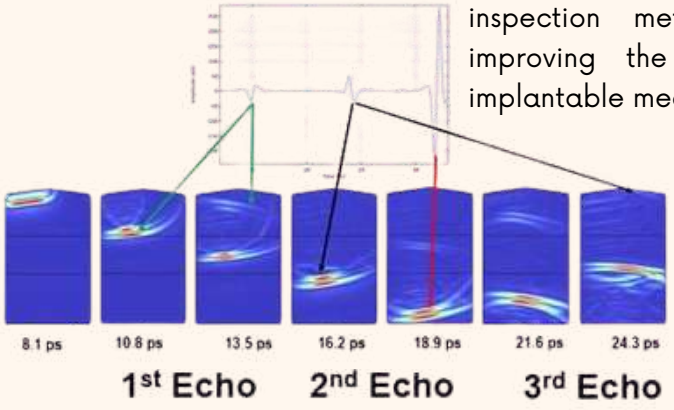
Her work aims to develop a faster, more reliable, and fully non-destructive method for microstructural characterization, with the long-term goal of offering a practical alternative to current destructive or time-consuming techniques.

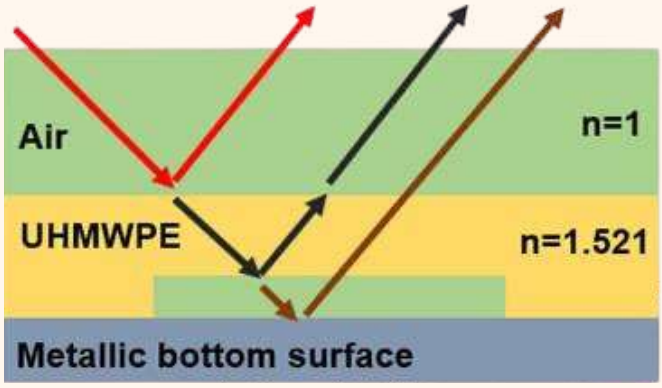


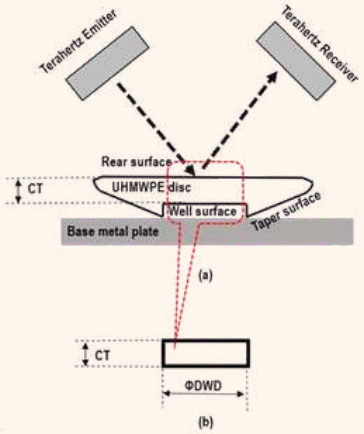
Subhash N. N

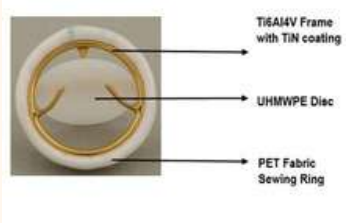
N. N. Subhash is an external Ph.D. research scholar in Mechanical Engineering at IIT Madras, working at the CNDE under the supervision of Prof. Krishnan Balasubramaniam since 2021. He is currently a Scientist/Engineer–D at SCTIMST, Government of India. He completed his M.Tech from IIT Madras in 2012, also at CNDE under the guidance of Prof. Balasubramaniam, where his work focused on ultrasonic waveguide-based fluid-level sensing. He holds a B.Tech in Mechanical Engineering from Government Engineering College, Thiruvananthapuram.

His doctoral research focuses on advancing Terahertz Time-Domain Spectroscopy (THz-TDS) for nondestructive evaluation, particularly for QA/QC of biocompatible implants and polymer-based medical devices. In his work, he investigates THz-based dimensional verification, degradation assessment, and ageing characterization of implantable components such as mechanical heart valve discs made of UHMWPE. His latest research demonstrates how THz-TDS can identify dual ageing mechanisms—surface polishing due to cyclic wear and bulk microstructural reorganization caused by accelerated durability testing—through simultaneous analysis of refractive index, extinction coefficient, and absorption coefficient. By integrating in silico modeling, in vitro measurements, and THz imaging, his work aims to establish reliable, non-contact, and high-precision THz inspection methodologies for biomedical applications, improving the safety, durability, and performance of implantable medical devices.









Shashank Sisodia

Shashank Sisodia is a Ph.D. research scholar in the CNDE Lab, working under the supervision of Prof. Krishnan Balasubramanian. His research focuses on developing an ultrasonic waveguide–based method for real-time characterization of viscous fluids. He works on designing torsional waveguides that enable multipoint viscosity measurement when dipped in Newtonian fluids.

By analyzing amplitude and time-of-flight variations along the waveguide, his work provides a simple and effective alternative to conventional rheometers for assessing fluid mechanical properties. Shashank's research further aims to translate this technique into industrial settings, particularly in oil, polymer, paint, and food processing, where continuous, online viscosity monitoring is critical for quality control. His contributions support the development of compact, scalable sensing solutions for modern process industries.

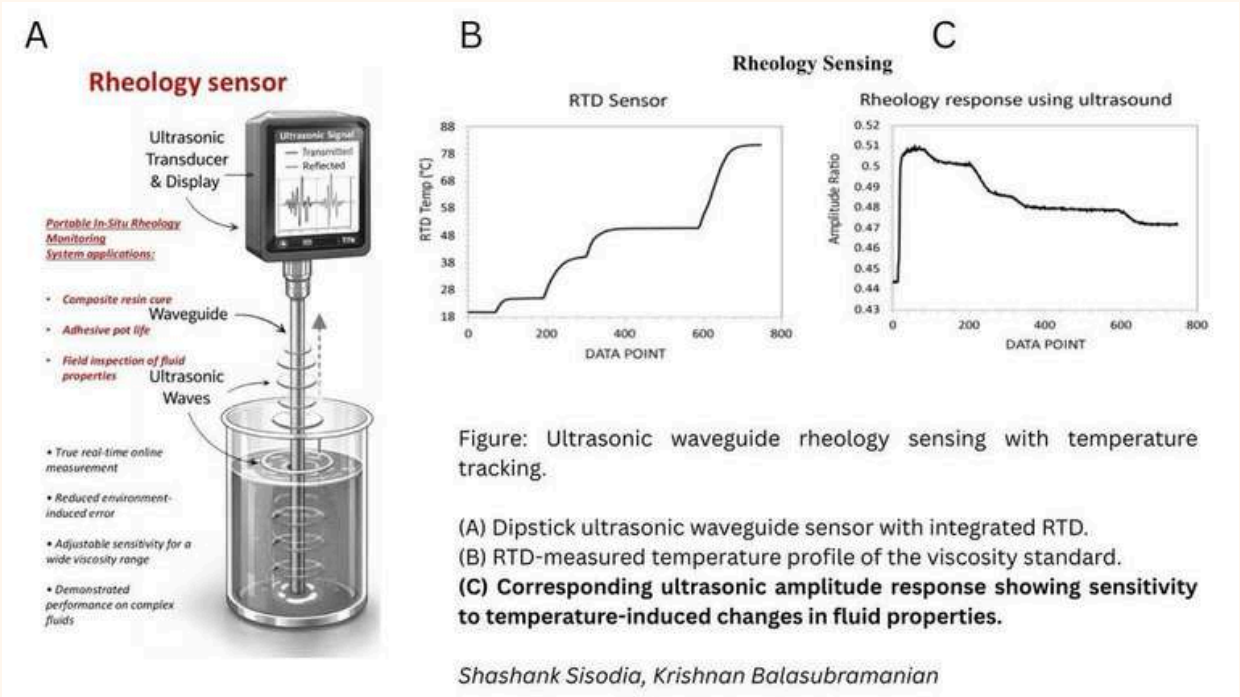


Figure: Ultrasonic waveguide rheology sensing with temperature tracking.

(A) Dipstick ultrasonic waveguide sensor with integrated RTD.
(B) RTD-measured temperature profile of the viscosity standard.
(C) Corresponding ultrasonic amplitude response showing sensitivity to temperature-induced changes in fluid properties.

Shashank Sisodia, Krishnan Balasubramanian

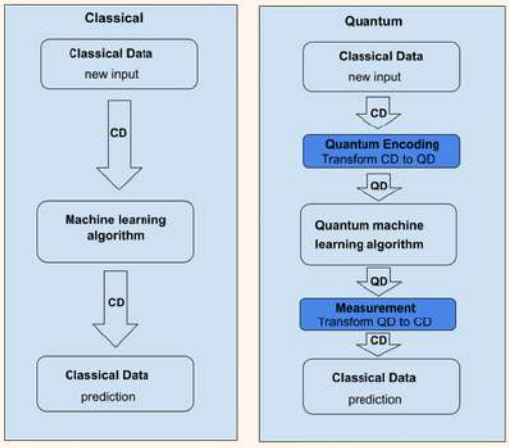
Amrita P

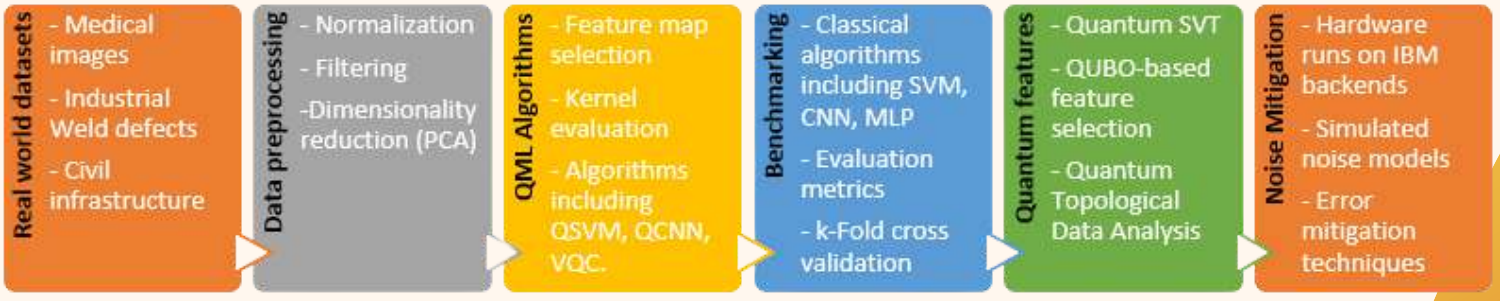
Amrita P. is a PhD scholar at the School of Interdisciplinary Studies, IITM working under the guidance of Prof. Prabhu Rajagopal and Prof. Krishna Jagannathan. Her main research area is Quantum Machine Learning and Systems Biology from Maulana Azad National Institute of Technology, Bhopal.

She is a Pure Mathematics student with a profound interest in Computer Science and Interdisciplinary Sciences. Her academic background includes an Integrated M. Sc., from University of Mumbai - Department of Atomic Energy Centre for Excellence in Basic Sciences and M. Tech. in Computational and Systems Biology from Maulana Azad National Institute of Technology, Bhopal.

It was during her second Masters' that her journey in Quantum Computing began. Her Masters' thesis work titled "Protein folding using Quantum Computing" focused on applying different quantum algorithms to solve lattice protein folding. It involved the study of the existing Hamiltonians, application of quantum algorithms to optimise the existing lattice models, and the development of a novel encoding on a diamond lattice, and optimizing the corresponding Hamiltonian on an IBM Quantum simulator.

She is deeply driven by the mathematical aspects of Quantum Machine Learning and its applications. Currently her work in CNDE is on Quantum Machine Learning solutions for automated Weld Defect Recognition. It involves applying various Quantum Machine Learning algorithms including the Variational Quantum Classifiers, Quantum Support Vector Machines etc., on weld defect data and benchmarking the results with existing classical methods





Srijan Tiwari

Srijan Tiwari is a research scholar at the CNDE, IIT Madras, working at the intersection of technology, digitalization, and research commercialization. Under the guidance of Prof. Krishnan Balasubramanian, his research focuses on NDE 4.0 — the digital transformation of Non-Destructive Evaluation through standardized, interoperable, and AI-assisted frameworks that advance traceability, reporting consistency, and workforce validation across the NDT ecosystem.His work has been presented at the DGZfP Annual Conference (Germany), ICNDE (Bangalore), and the Singapore International NDT Conference (SINCE) in 2025 — collectively advancing unified digital ecosystems that connect inspection, procurement, training, and workforce management under a shared data framework aligned with ISO 17020 and ASME Section V. His publication at IWSHM 2025, Stanford University, titled "Bridging the Knowledge Gap in NDE 4.0: AI-Augmented Insights Through Retrieval-Augmented Generation (RAG)", presents an AI-powered knowledge assistant delivering real-time technical guidance to NDE practitioners via semantic search and large language models.

As Co-founder of TIQ World Pvt. Ltd., a deep-tech startup incubated at IIT Madras, he operationalizes NDE 4.0 by integrating e-commerce, AI, and workforce intelligence to streamline industry access to testing devices, certifications, and skilled professionals.
In 2025, he was one of 35 innovators selected worldwide for the International Summer School on Knowledge-Driven Innovation at the University of Luxembourg.

With a background in Mechanical Engineering and an MS in Entrepreneurship from IIT Madras, his mission is to build digital infrastructure that strengthens manufacturing quality, traceability, and next-generation inspection systems.

Sanidhya Chaturvedi

Sanidhya Chaturvedi is a research scholar at the CNDE, IIT Madras, and Co-founder & Director of Folium Sensing - a deep-tech startup pioneering advanced fiber-optic sensing systems for real-time monitoring of infrastructure, industrial assets, and defense applications.

Under the MS (Entrepreneurship) program, and mentored by Prof. Krishnan Balasubramanian and Prof. Balaji Srinivasan, his research focuses on Distributed Sensing - developing AI-assisted fiber sensing frameworks for structural health monitoring, tunnel safety, and smart infrastructure. His work bridges laboratory innovation with commercial deployment, bringing field-ready fiber sensing solutions to industry at scale.

Folium Sensing has achieved significant traction: securing a collaboration with TDK Japan for HVAC monitoring, receiving its first industrial order from Forbes Marshall, and conducting field trials at Roopnarayan Bridge (Kolkata), Indo-China Borders (Tenga Valley), Tata Steel (Jamshedpur), GAIL, and CSIR-NAL (Bangalore).

Sanidhya's entrepreneurial excellence has been recognized through four national-level awards: Youth Icon of the Year 2025, National Winner - Google FutureX 2025, and First Prize at SANGAM 2025 Pitchfest organized by the IIT Madras Alumni Association. His work has been featured in The Times of India and other national publications.

His mission is to harness fiber-optic technology to build a safer, smarter, and sustainable world - advancing India's leadership across infrastructure health, defense systems, industrial automation, and environmental intelligence on the global deep-tech stage.

Kaushik Narayanan

Kaushik V N is a research scholar pursuing MS (Entrepreneurship) at IIT Madras, working at the intersection of advanced inspection technologies, autonomous systems, and deep-tech commercialization. As a second-time entrepreneur, he brings over a decade of startup experience to his current focus — building a next-generation radiographic inspection and scanning venture that redefines how industries visualize and secure the unseen across infrastructure, energy, aerospace, and defense.His earlier venture, Rail Labs, addressed a critical gap in railway safety by deploying an autonomous inspection robot equipped with multi-sensor technology — combining ultrasonic flaw detection, laser profiling, and AI-powered vision — to identify internal fractures, track buckling, and surface defects without disrupting rail traffic. By integrating big data analytics and cloud platforms, the system enabled predictive maintenance, reduced human error, and extended track lifespan. He presented this work at the Global Rail Conference, where his talk on autonomous track inspection vehicles was well received by the international rail community.

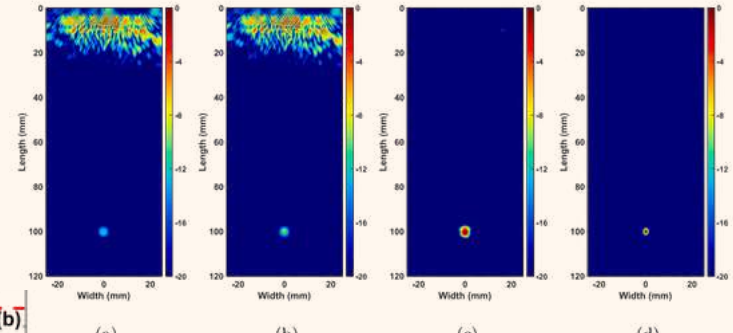
Building on this foundation, he is now pioneering X-ray backscatter-based inspection systems — integrating AI analytics for real-time anomaly detection and fully non-intrusive scanning — targeting the oil and gas, border security, infrastructure, and aerospace sectors.

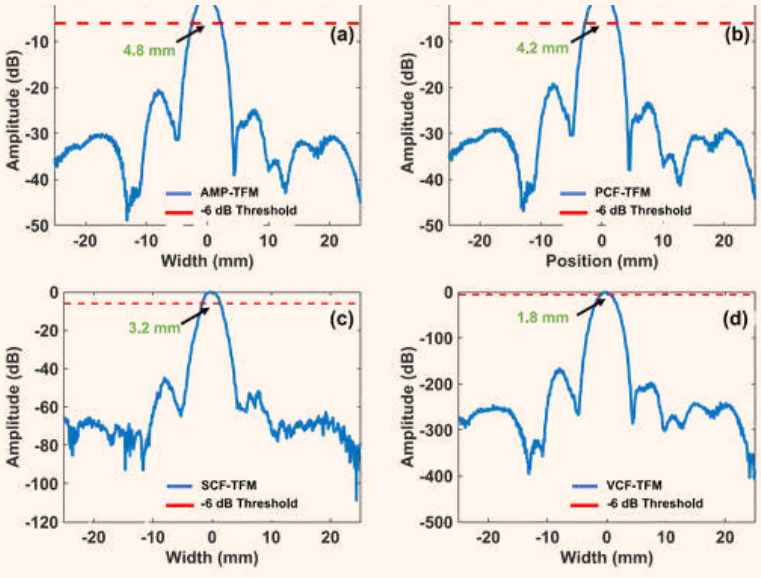
His approach consistently transitions industries from manual, workforce-intensive methods to proactive, data-driven inspection strategies. With a blend of entrepreneurial resilience and academic rigor, his mission is to develop intelligent inspection infrastructure that raises global safety and operational standards across critical industries.

Kaushal Jagannath Bachhav

Kaushal Bachhav is an M.S. (Research) scholar in the Department of Mechanical Engineering at IIT Madras, working under the guidance of Prof. Krishnan Balasubramaniam. His research focuses on advanced signal processing and imaging algorithms for NDE, with a particular emphasis on plate-like thin walled structures.He completed his Bachelor's degree in Mechanical Engineering from Savitribai Phule Pune University. His interest in ultrasonics, guided waves, and computational approaches to NDE motivated him to pursue interdisciplinary research in this domain.During his MS research work, Kaushal developed novel phased array based imaging algorithms for defect detection in plate inspection applications. His work involved studying wave propagation in thin structures, formulating improved imaging frameworks, and validating these techniques through simulations and experiments using phased array ultrasonic systems.

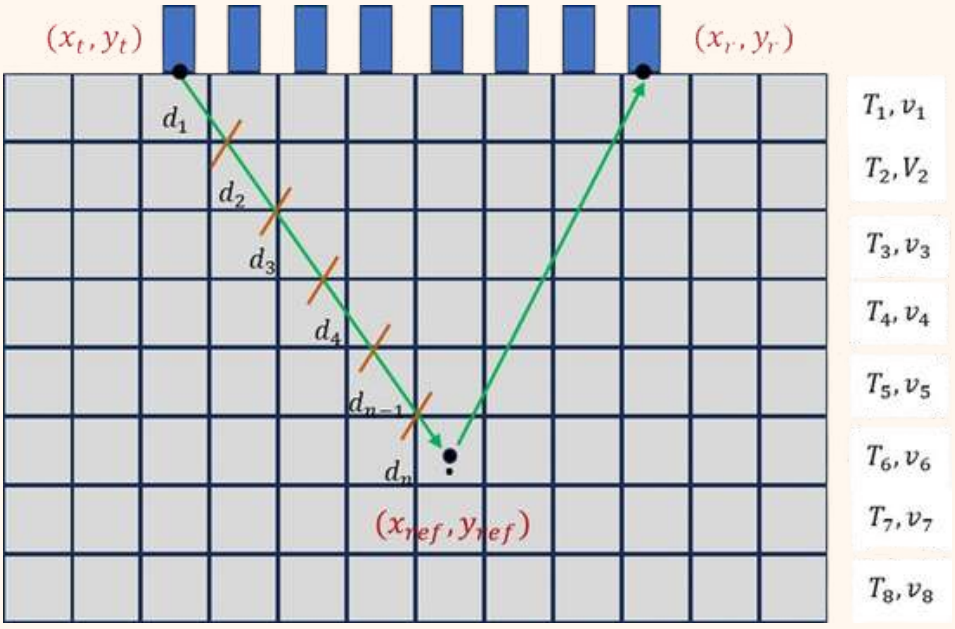
His contributions have led to enhanced imaging methodologies capable of accurately detecting and characterizing defects in challenging thin-plate geometries. Kaushal's broader research interests include phased array ultrasonics, guided wave imaging, advanced signal processing, machine learning, and deep learning for NDE. He remains driven by the goal of creating innovative and computationally efficient solutions for real world industrial inspection challenges.



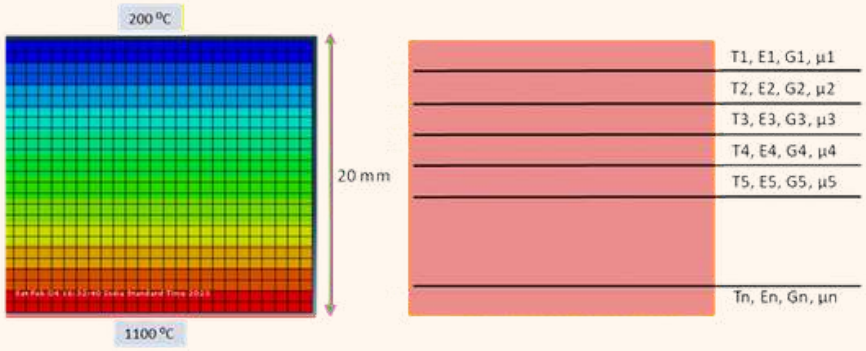


Kartik Ramesh Page

An MS (Research) scholar in Machine Design at IIT Madras, working in the CNDE lab under the guidance of Prof. Krishnan Balasubramanian. His research, in collaboration with TATA Steel, focuses on developing a high-temperature phased array ultrasonic sensor for characterising the solid/liquid interface during continuous casting of steel. His work includes automating Full Matrix Capture (FMC) data acquisition for phased array ultrasonic testing, finite element modelling of solidifying steel or advanced ultrasonic evaluation, development of a velocity-compensation algorithm for accurate solidification front detection, implementation of Total Focusing Method (TFM) imaging in MATLAB, and the design and thermal analysis of a high-temperature sensor assembly with integrated cooling for operation at 600°C.



Velocity Compensation Algorithm

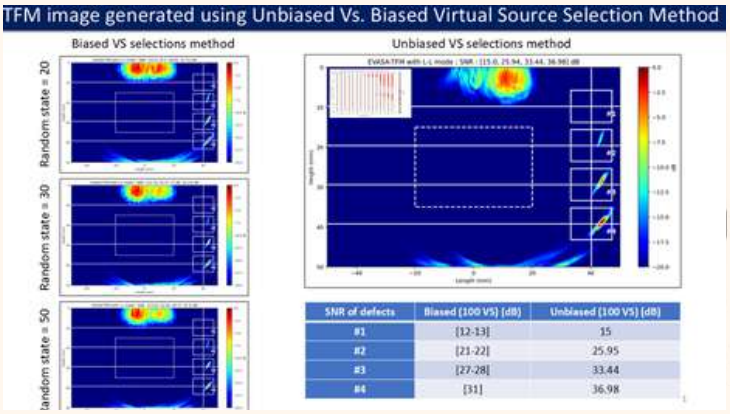


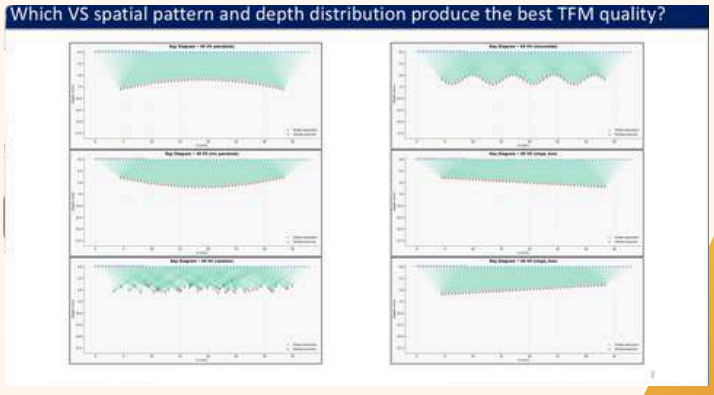
Spatial variation of material properties for temperature gradient

Thacker Setu Rameshbhai

Setu Thacker, originally from Kutch, Gujarat, is a Master's research scholar at CNDE, IIT Madras, under the mentorship of Prof. Krishnan Balasubramanian. His research focuses on advancing Phased Array Ultrasonic Testing (PAUT) — developing innovative ultrasonic imaging strategies using virtual sources, quantitative defect characterization methods, and simulation-guided inspection designs for high-reliability industrial applications

His work earned an invitation from Stanford University to present at the International Workshop on Structural Health Monitoring (IWSHM 2025), where he showcased his groundbreaking ultrasound imaging approach using virtual sources — a recognition of his contributions to the forefront of ultrasonic inspection research.Alongside his academic work, Setu plays a key role in a nationally significant initiative to modernize NDT for the Indian Navy — spearheading the transition from conventional Radiographic Testing to PAUT for thick austenitic and low-alloy steel components. This collaborative project with DRDO, IGCAR, and L&T Precision Engineering (Hazira) has advanced Probability of Detection (PoD) outcomes and delivered field-validated, ASME-compliant inspection procedures for submarine welds.
His methodology integrates high-fidelity Finite Element Analysis (FEA) simulations, array-sensor signal processing, and field experience to build ultrasonic evaluation frameworks suited for demanding industrial environments. He is driven to converge traditional NDT with machine learning, robotics, automated defect recognition, and digital-twin methodologies — enabling the next generation of intelligent inspection systems.Setu welcomes collaboration with industry partners committed to advancing Non-Destructive Testing and structural health assessment.





Mahalakshmi S

Mahalakshmi S is a research scholar in the MS (Entrepreneurship) program at IIT Madras and the founder of Gemicates, a technology startup currently pre-incubated under Nirmaan, IIT Madras. Her work focuses on developing intelligent, secure, and scalable systems by integrating Artificial Intelligence (AI), Internet of Things (IoT), and blockchain technologies.She is driven by a vision to build resilient and user-centric smart environments that addressreal-world challenges in automation, security, and digital trust

Gemicates – Smart Automation & Surveillance

Gemicates develops next-generation smart automation and surveillance solutions that areinteroperable, secure, and reliable. The platform enables seamless integration across devices,vendors, and systems, ensuring flexibility and scalability. A key differentiator is its offline capability, allowing critical functions to operate even without continuous internet connectivity. Combined with a security-first architecture and AI-driven intelligence, Gemicates aims to deliver robust and future-ready solutions.

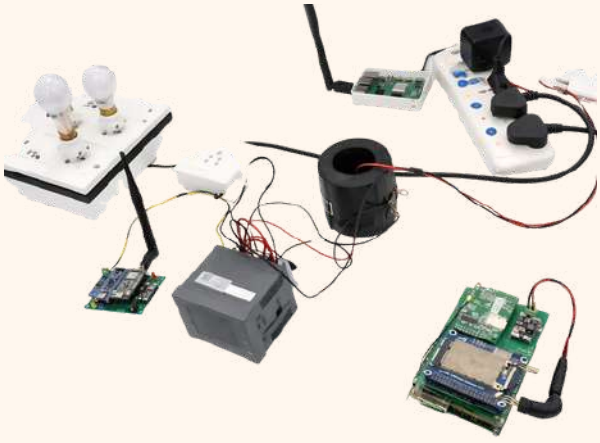
Flagship Project – GEMESH

GEMESH (Intelligent Home Surveillance and Management System) is the flagship solution under Gemicates. It integrates AI, IoT, and blockchain to provide a comprehensive smartecosystem for automation, monitoring, and security.

Key Features:

1. AI-powered real-time surveillance and threat detection
2. IoT-based smart automation
3. Secure data management using blockchain
4. Interoperable system architecture
5. Offline-enabled functionality
6. Centralized monitoring and control

GEMESH is designed to enhance home security, improve energy efficiency, and ensure data
privacy across diverse environments.



S.P. Shri Jayanthi

S. P. Shri Jayanthi is a seasoned technology and governance leader with over two decades of experience in public administration, infrastructure management, and tech consulting. As the Designated Partner of TECHXLN SYS LLP and founder of ShakthiAI, she drives initiatives in AI, Cybersecurity, and GovTech. A top performer in the TNPSC Group I examination, she has held key roles in the Tamil Nadu Government, including on the Cyber Security Specialist Committee. An alumna of Anna University, IIM Ahmedabad, and the Australian National University, she has represented India in global cyber partnerships. Her leadership in projects like the Tamil Nadu State Data Centre has earned her Best Governance Awards, and she has led numerous high-profile events with senior government leadership.

Project with CNDE – AI-Driven Intelligent Document Ecosystem:

Under S. P. Shri Jayanthi's leadership, TECHXLN SYS LLP is revolutionizing document-heavy processes for CNDE with AI-driven automation and intelligence. Key outcomes include:

1. AI-Powered Document Processing – Reduces manual effort by 60–80%, enhances data accuracy to 90%, and cuts cycle time by over 50%.
2. AI Dictionary for National Libraries – Boosts search efficiency by 3–5x and enables multilingual, contextual understanding of archival content.
3. AI-Based Tender Evaluation – Cuts evaluation time by 40–70%, ensuring standardized, bias-free assessments and enhancing transparency.
4. AI Personalization & Companion Systems – Doubles or triples user productivity with contextual recommendations and adaptive decision support.

Amit Jain

Amit is a second-year MS (Research) student in the CNDE lab, working under the supervision of Prof. Prabhu Rajgopal. His research is positioned at the intersection of AI and Robotics, focusing on the innovative field of Vision-Language-Action (VLA) models. This work is a crucial component of the broader Physical AI domain, which aims to develop intelligent, embodied agents that can autonomously perceive, reason, and act safely within dynamic physical environments.

The core objective of Amit's research is to develop advanced VLA models specifically tailored for complex robotic manipulation tasks. Trained extensively on robotic interaction data, these models are designed to be embodiment-agnostic, meaning a single generalized model can effectively operate across various types of robotic arms and hardware. A practical application of this research is autonomous battery assembly in manufacturing, where a robot must visually identify different battery types and dynamically adapt its assembly sequence accordingly. A key aspect of his approach is embedding reasoning capabilities into these VLA models. This crucial integration allows the agents to engage in real-time action planning to complete assigned goals, significantly improving their capability to succeed in complex, long-horizon scenarios. Concurrently, he is contributing to an Accenture project, developing a unified framework to train, test, and seamlessly evaluate VLA models within physics-based simulation engines.

Parthasarathi Samanta

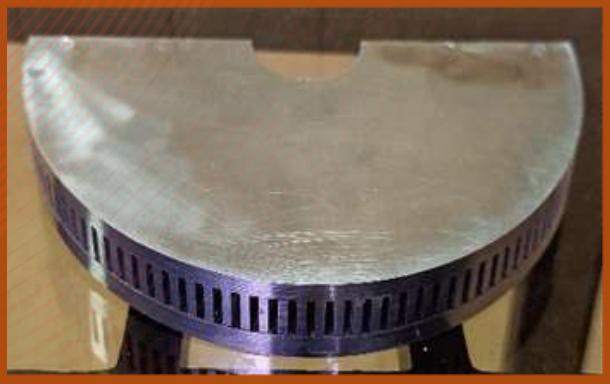
Parthasarathi is an M.S scholar at CNDE, IIT Madras, under supervision of Prof. Krishnan Balasubramanian since 2024, focused on material characterization of polycrystalline microstructure with varying grain size to assess the hardness gradient distribution in a polycrystalline material. The main objective of his research is to systematically investigate and experimentally validate how grain size variations within polycrystalline microstructures affect the propagation, scattering, and attenuation of ultrasonic waves, thereby providing deeper insights into microstructural effects on non-destructive evaluation and improving the interpretation of ultrasonic signals in engineering materials.

His work involves generating synthetic microstructures using Voronoi tessellation for precise control over grain morphology, implementing and enhancing 2D elastic FDTD methods for ultrasonic backscattering studies, extending computational strategies to 3D domains, and integrating experimental microstructure data for model validation. Additionally, he is improving computational schemes—including Lebedev finite differences—within the FDTD framework, modeling grain scattering noise, and applying these models for advanced defect imaging and scattering analysis in complex materials such as dual-phase and textured materials.

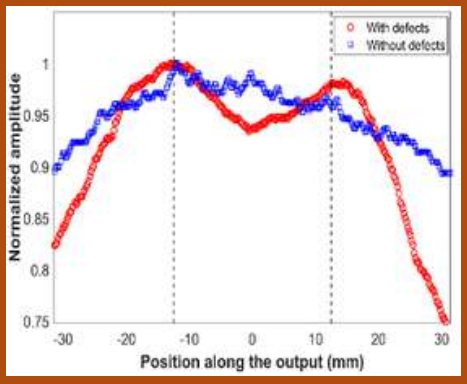
CURRENT PROJECT

M-SAM: MICRO-HYPERLENS-ENHANCED ACOUSTIC MICROSCOPY FOR FAR-FIELD IMAGING

This project focuses on the development of an advanced Scanning Acoustic Microscopy (SAM) system integrated with a micro-fabricated hyperlens (μ-hyperlens) to enable high-resolution, non-destructive imaging beyond conventional diffraction limits. Ultrasound imaging, widely used in NDE and biomedical applications, is inherently limited by the Rayleigh diffraction limit, restricting its resolution and applicability in high-precision domains such as semiconductor and microelectronics inspection.To overcome this limitation, the project aims to develop an indigenous SAM system capable of sub-wavelength resolution with far-field magnification. At CNDE, the concept of 'super-resolution along with magnification' in the ultrasonic domain is demonstrated using a custom-fabricated metallic hyperlens, shown in Fig. 1(a). Building on prior advancements at CNDE-IITM that demonstrated super-resolved image with five-fold magnification in the ultrasonic domain (as illustrated in Fig. 1(b)), the proposed system is designed to operate at 25 MHz, achieving a resolution of approximately 20 μm with up to 10 times magnification, significantly outperforming conventional systems.The proposed system comprises a high-frequency ultrasonic transducer, μ-hyperlens with waveguide sensor, precision nano-motion scanning platform, and advanced data acquisition and imaging software. It offers a scanning range of 300 × 300 mm with high spatial precision, enabling real-time inspection of semiconductor devices, MEMS, NEMS, and integrated circuits. A key innovation is the μ-hyperlens, which enables the conversion of evanescent waves into propagating waves, facilitating far-field imaging of subwavelength features. The expected outcome is an indigenous, cost-effective alternative to X-ray micro-tomography systems, supporting semiconductor inspection and contributing to self-reliance in high-end characterization technologies



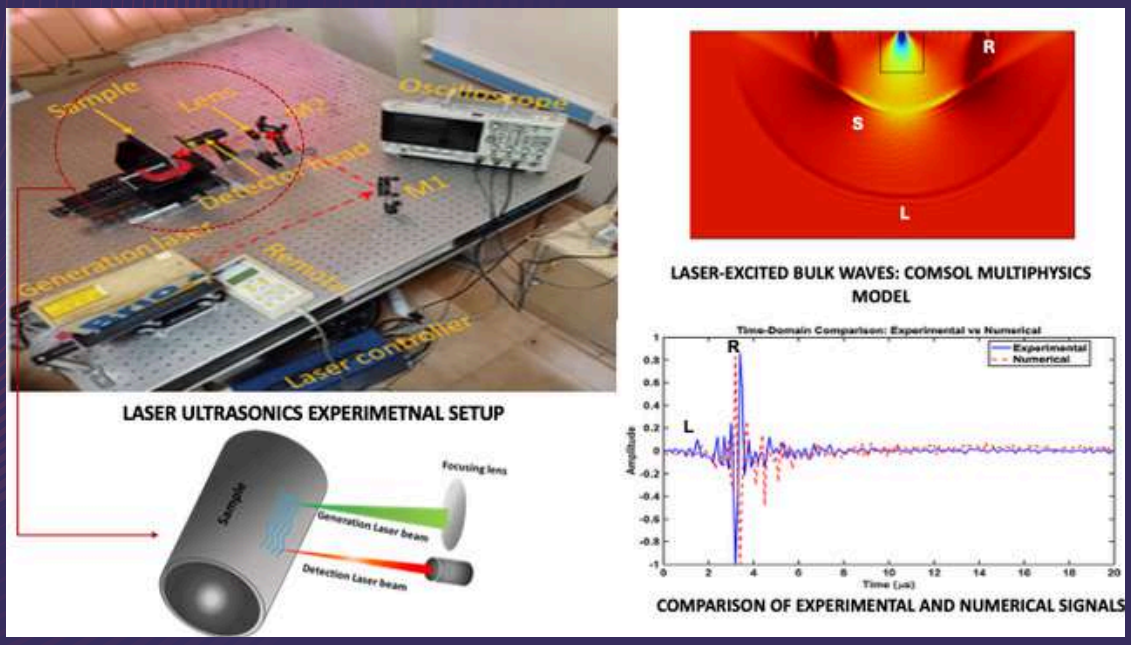
Cylindrical hyperlens fabricated at CNDE for Far-field Imaging



Experimental results from 5X hyperlens showing the magnified image for defects separated by a subwavelength distance of 5 mm (λ/3), with and without defects

LASER ULTRASONICS FOR DEFECT CHARACTERISATION IN COMPLEX METAL COMPONENTS

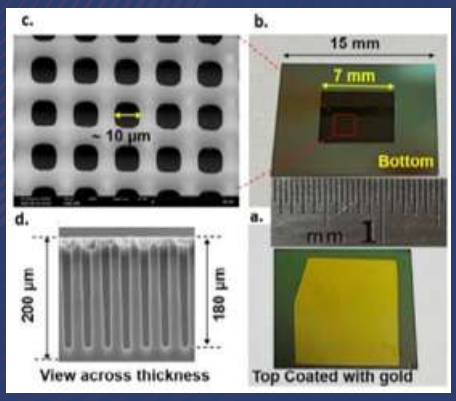
Laser ultrasonics is a non-contact technique for inspecting materials using laser light to both generate and detect ultrasonic waves. A short pulse from a generation laser is focused onto the surface of a sample, where rapid thermoelastic expansion launches elastic waves into the material. A second detection laser picks up the nanometre-scale surface displacements caused by these waves at another point on the sample, converting mechanical motion back into an electrical signal without ever physically touching the part. Because neither source nor sensor makes contact, the technique is particularly well suited to components where conventional piezoelectric transducers struggle, curved surfaces, high-temperature parts, components with complex geometry, or situations where couplant cannot be applied. In our current work, we use a laser ultrasonics setup validated against a COMSOL Multiphysics numerical model to develop signal processing methods for quantitative characterisation of subsurface defects in metallic components with complex geometries.



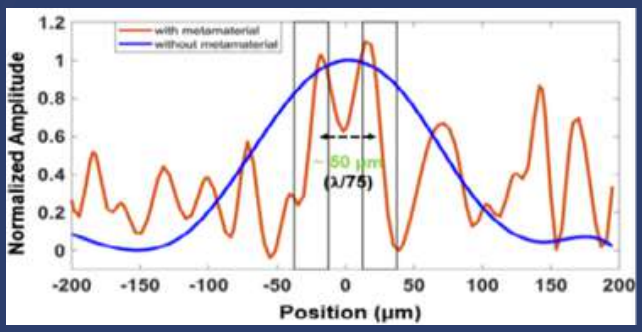
Laser Ultrasonics for non-contact defect characterisation

NEXT GENERATION PHASED ARRAY ULTRASONICS FOR ULTRA HIGH PRECISION DIAGNOSTICS

This project aims to enhance the resolution capabilities of Phased Array Ultrasonic Testing (PAUT) through the integration of advanced ultrasonic metamaterials, addressing key limitations in conventional NDE. PAUT is widely used in industries such as aerospace, oil and gas, and manufacturing due to its ability to electronically steer and focus ultrasonic beams. However, its resolution is fundamentally limited by diffraction, restricting the detection of fine defects such as microcracks, clustered porosity, and early-stage material degradation.To overcome these challenges, the project proposes the integration of Structured Channel Metalenses (SCMs) with phased array transducers to achieve subwavelength imaging resolution. Building on prior advancements at IIT Madras, including the development of a micro-metamaterial lens (as illustrated in Fig. 1(a)) capable of achieving resolutions up to λ/75 (as shown in Fig. 1 (b)), this work seeks to extend these capabilities to practical PAUT systems for real-world inspection scenarios.The proposed methodology involves a two-stage approach. In the 1st stage, the SCM-integrated PAUT system will be designed, optimized, and experimentally validated for subwavelength imaging in controlled samples. In the 2nd stage, the approach will be extended to complex industrial applications such as weld inspection, targeting challenging defects including cluster porosity, hydrogen-induced damage, and microstructural anomalies.A key innovation of this project lies in the ability of metamaterials to enhance evanescent waves, enabling detection of features beyond the diffraction limit without reliance on expensive or bulky systems such as laser vibrometry or X-ray computed tomography. The expected outcomes include the development of a high-resolution, cost-effective, and radiation-free ultrasonic imaging system, with strong potential for industrial adoption in critical sectors.



Micro-metalens developed at CNDE-IITM



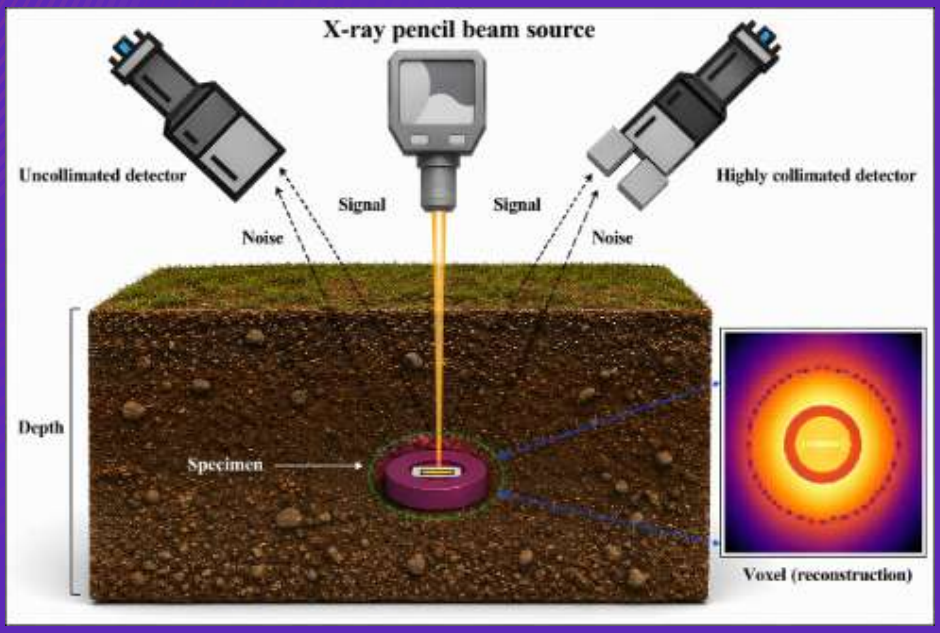
Experimental B-scan data showing resolution up to λ/75 using micro-metalens

Compton Back Scattering Imaging

Compton Backscattering (CBS) imaging is a powerful technique for non-destructive internal characterization in scenarios where conventional transmission methods are limited by restricted access, high attenuation, or single-sided inspection constraints. It utilizes the energy and angular distribution of backscattered photons to probe subsurface features and detect variations in material density and composition.Under an ongoing DRDO-oriented research project, CBS is being explored for the detection of buried objects using FLUKA, a Monte Carlo–based particle transport simulation widely used to model photon–matter interactions with high accuracy. These simulations help in understanding scattering behavior, optimizing system parameters, and improving detection sensitivity.In parallel, a dedicated simulation package is being developed to systematically study key variables affecting backscattering, such as incident photon energy, scattering angle, material properties, detector configuration, and geometry. This framework aims to support multiple real-world applications.

Applications of CBS Imaging:

- Corrosion Under Insulation (CUI): Detection of material degradation beneath insulating layers
- Buried Object Detection (concealed explosive): Identification of concealed objects using single-sided inspection
- Archaeology: Non-invasive detection of subsurface artifacts without excavation
- Security Screening: Inspection of concealed or inaccessible objects in critical environments, cargo inspection



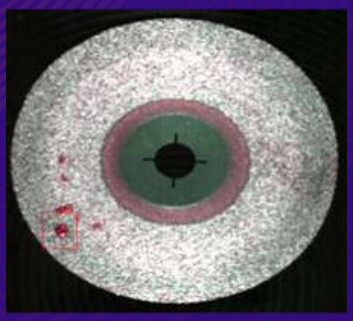
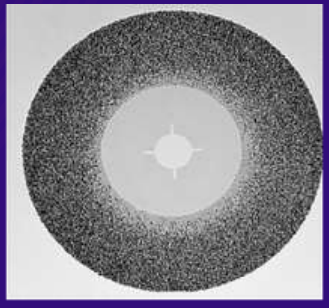
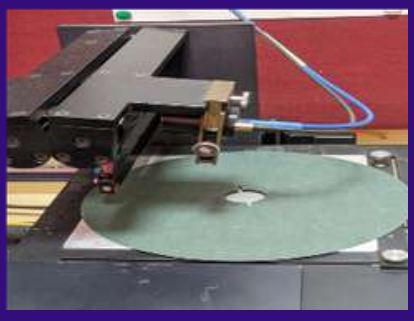
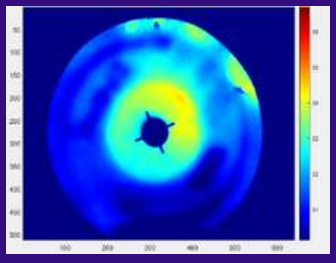
Representation of CBS and Reconstruction of the buried object in soil

NDE Studies on Saint-Gobain Fibre Disc

This study evaluates fiber discs and grinding wheels from Saint-Gobain Research India using advanced NDE techniques to analyze internal structures and material composition without causing damage.

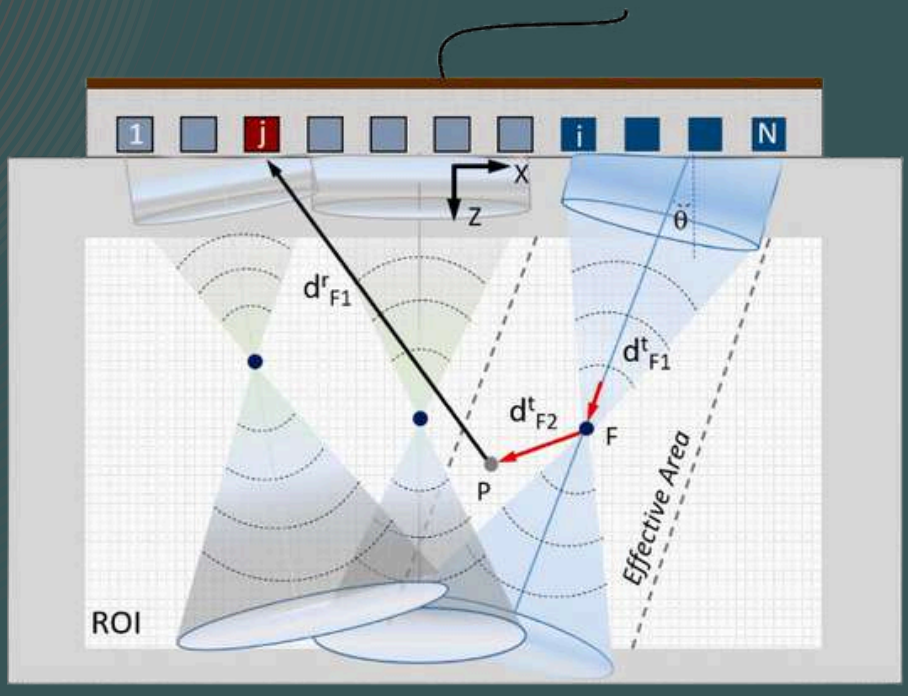
Key Results & Findings

- **Infrared Thermography**: Flash thermography (5 cycles of 10s heating/cooling) successfully detected surface and near-subsurface defects. Defective zones-including delaminations and artificial defects-exhibited thermal non-uniformity and altered heat flow. Water-exposed regions showed enhanced cooling rates, indicating compromised bonding.
- **Terahertz (THz) Imaging**: Time-domain imaging mapped reflectivity variations across sample layers. High-reflectivity "yellow zones" in dry samples indicated internal voids or fiber density mismatches. Long-term monitoring of water-exposed samples revealed diffusion-driven pattern smoothing and signal attenuation over two weeks.
- **Hyperspectral Imaging**: This method provided spectral reflectance profiles sensitive to minor chemical inhomogeneities invisible to standard imaging. It effectively identified variations in resin content, fiber density, and potential contaminants.
- **Micro-Computed Tomography (CT):** Provided high-resolution 3D visualization of internal features and voids, serving as a structural baseline for the other NDT techniques.
- **Conclusion**: The integrated use of these four complementary techniques allows for a multi-scale evaluation of abrasive tools, significantly improving quality control and manufacturing process optimization.

AVASA – Arbitrary Virtual Array Source Aperture

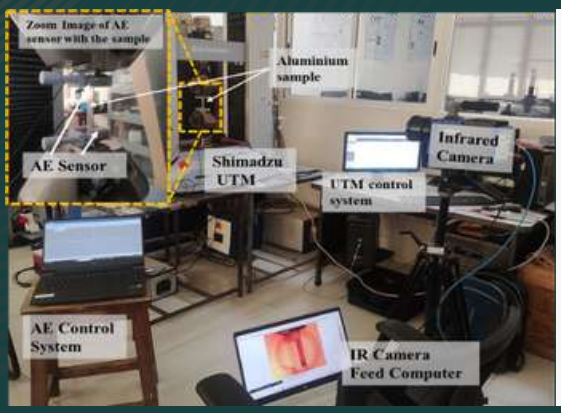
The AVASA technique uses phased array elements to transmit the ultrasound wave with pre-calculated delay laws to create the beamforming to focus at arbitrary virtual source locations placed below the physical transducer. The schematic of the AVASA method is shown in Fig. 1. The selective elements groups are created to form the active aperture in the transducer array and triggered with pre-calculated focal laws between the active aperture and the virtual sources. In this technique, the ultrasound beam is steered and focused on reaching the virtual source due to the arbitrary positions of the virtual sources. Then it diverges into the medium, which increases the transmitted energy and a broader inspection angle. The AVASA technique consists of multiple virtual sources arbitrarily located below the transducer. The corresponding active aperture is selected for each virtual source to create the beamforming. To reduce the image processing time, the number of transmissions to be fewer, and at the same time, the image resolution should be improved. Therefore, virtual source parameters (VSP), such as the number of virtual sources, their location, and corresponding active aperture groups, are determined using the Poisson point process (PPP) in the underlying space of the physical transducer. The PPP is a random process, and each transmission-related VSP is a bounded subregion under the physical transducer, which is completely independent of all the other VSPs of the transmissions. The possible number of active aperture (NAP) in a given transducer is (N-n+1), where 'N' is the number of elements in the transducer, and 'n' is the number of elements in the active aperture. These combinations of the NAP cover the full array width.

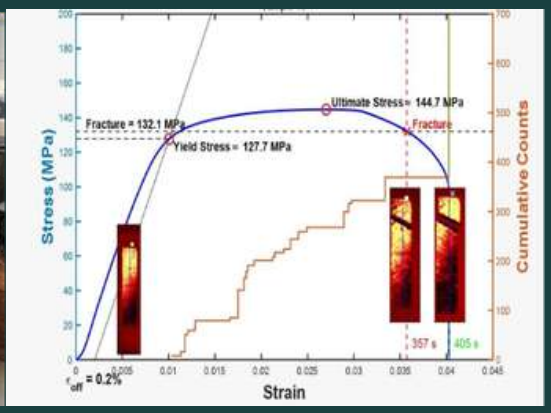


The schematic diagram illustrates the path followed by the wave in the AVASA imaging. Active aperture is triggered with pre-defined delay laws to converge the beamforming at F arbitrarily located virtual sources below the transducer to the point P in the effective area and then back to the receiver element j.

NDE Technique to capture crackgrowth evolution for samples under static loading

This project deals with the combined study of Acoustic Emission (AE) and Infrared Thermography (IRT) for the characterization of crack initiation and failure in thin aluminium (ASTM E8) specimens without notches under static tensile loading using a Universal Testing Machine (UTM). AE, a passive NDE technique, enables real-time monitoring of transient elastic waves generated due to microstructural changes, while IRT provides full-field thermal mapping of heat evolution during the loading process up to failure.The primary objective of this study is to capture AE signals during tensile loading and the associated heat generation using IRT, and to correlate these responses with the stress–strain behaviour across elastic, plastic, and fracture regimes. During the experimental investigation, several challenges were encountered. Maintaining proper alignment of specimens and synchronizing the operation of the UTM, AE system, and infrared camera. The results indicate that AE activity begins prior to yielding and remains consistent across all specimens, with variations in the number of hits. Fracture was observed to occur at approximately 92–98% of the ultimate tensile strength. The elastic regime is characterized by low-amplitude AE signals associated with minor microstructural activity, whereas the plastic regime exhibits moderate AE activity due to intensified deformation mechanisms. In the fracture regime, fewer but high-amplitude AE signals are recorded, corresponding to rapid crack propagation and final failure. The cumulative AE counts, when correlated with stress–strain response and thermal profiles, provide a clear indication of impending failure well before its occurrence. Fractographic analysis using SEM revealed elongated and equiaxed dimples near the fracture surface, indicating ductile failure. Overall, AE activity during tensile testing is influenced by factors such as microstructure, inclusion content, fabrication history, and strain rate. The integration of AE, IRT, and fractographic analysis provides a comprehensive understanding of damage evolution, enabling effective characterization and potential life prediction of aluminium ASTM E8 specimens under static loading.





QUANTUM ALGORITHMS AND ARCHITECTURE FOR NEXT GENERATION DIAGNOSTICS AND BEYOND AT SCALE

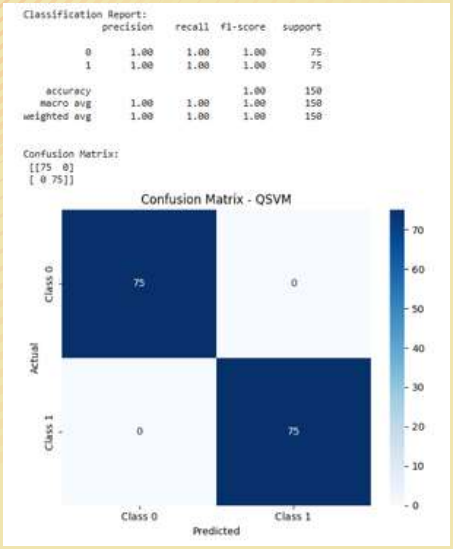
This project aims to investigate the conditions under which Quantum Machine Learning (QML) algorithms can offer a practical quantum advantage in real-world, data-limited settings. While theoretical advances have demonstrated the potential of quantum-enhanced learning models, empirical validation on structured, high-impact datasets remains sparse. The core scientific objective is to explore whether QML models can outperform classical baselines in domains where data is scarce, costly or structurally complex. Application-driven use cases will include NDE in aerospace and defence (e.g., weld defect recognition), and UAV-based civil infrastructure monitoring and finance datasets. In the short term, the research will generate rigorous, empirically validated insights into the viability of QML for structured datasets and develop classification tools to aid algorithm selection. In the long term, the framework and insights produced will serve as foundational infrastructure for domain-specific QML deployments.

THE OBJECTIVES I

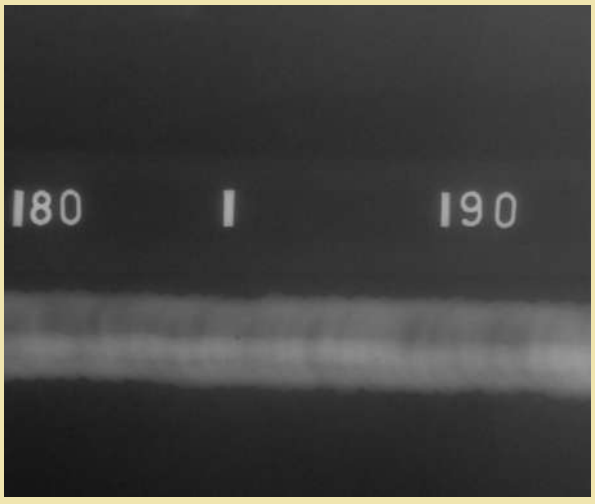
1.To formulate an epistemological framework for categorising machine learning problems and guiding algorithm selection across classical and quantum domains.

2. To rigorously quantify practical quantum advantage in machine learning workflows. We will define and compute concrete indicators of quantum benefit across three key dimensions: (i) Sample Efficiency (ii) Computational Speedup
(iii) Classical Intractability

3. To develop a principled, prescriptive framework for algorithm selection tailored to problem and data characteristics.



Confusion Matrix



CNDE Startups

DHVANI RESEARCH
Making Technology Work

Dhvani Research
Founded: 2008
Sector: Deep-Tech | Ultrasonics | NDE

Founders: Dr. Krishnan Balasubramanian, Sujatha Chakravarthy, K. S. Venkataraman

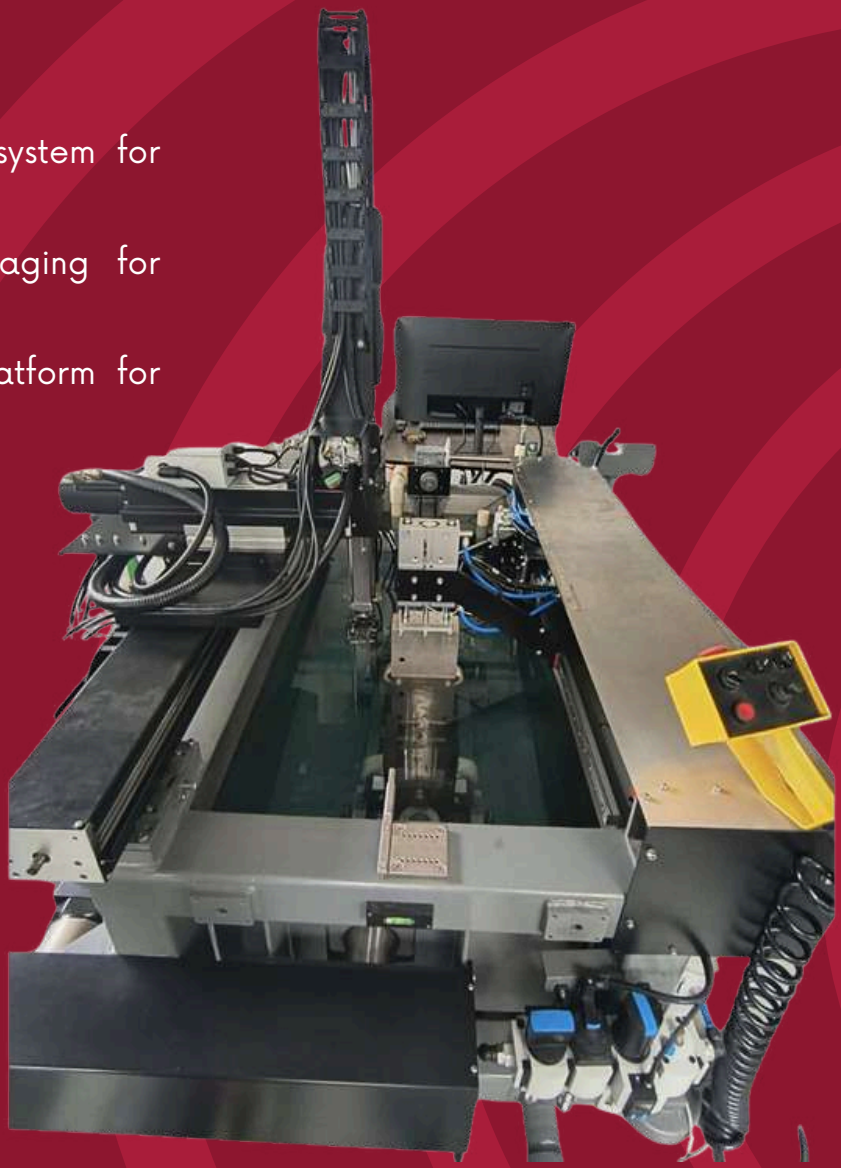
Dhvani Research develops advanced ultrasonic and robotic inspection systems for detecting internal defects in industrial materials without damage. Their solutions combine sensing, automation, and AI-driven analytics to ensure structural integrity and asset reliability.

Core Products

TASS: Automated ultrasonic scanning system for industrial inspection

SHRUTI: High-resolution ultrasonic imaging for R&D and quality control

Dhvani AI / SWASTH AI: AI-based platform for defect detection and asset monitoring



https://www.dhvaniresearch.com/

AZERIRI
SUSTAINABLE SENSOR INNOVATIONS

AZERIRI

ABOUT

Founded: 2008
Sector: Ultrasonics | NDE | Sensors

> Azeriri develops high-end ultrasonic transducers, hydrophones, and customized scanning systems for industrial and underwater applications. Its solutions translate advanced acoustic research into real-world inspection and monitoring technologies.

Core Products

- **Ultrasonic Transducers & Air-Coupled Systems:** Defect detection in materials with contact and non-contact methods
- **Hydrophones & Underwater Sensors:** Precision acoustic sensing for marine and structural monitoring
- **Custom Scanning & Battery Monitoring Systems:** Advanced NDT platforms for structural integrity and battery health analysis

https://azeriri.com/

PLANYS TECHNOLOGIES

Founded: 2015
Sector: Deep-Tech | Underwater Robotics | NDE

About

Founders: Tanuj Jhunjhunwala, Vineet Upadhyay, Prof. Prabhu Rajagopal, Prof. Krishnan Balasubramanian, Rakesh Sirikonda

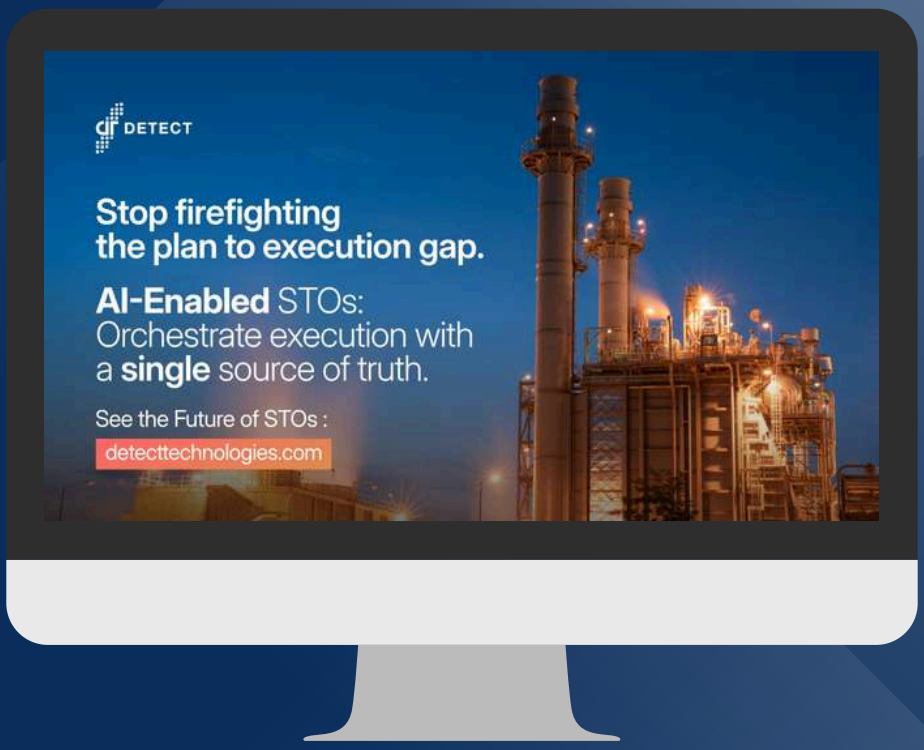
Planys Technologies is an IIT Madras-linked deep-tech startup specializing in underwater robotics and inspection solutions. It develops ROVs and AUVs with advanced sensing technologies for asset inspection in sectors such as oil & gas, ports, dams, and bridges.

Core Products

- **ROV Series (Mikros, Beluga, Orca):** Underwater drones for inspection and ultrasonic testing
- **Svaayatt (AUV):** Autonomous system for mapping and survey missions
- **Planys Analytics Dashboard (PAD)**: AI-based platform for defect detection and predictive maintenance

https://planystech.com/

Detect Technologies



Founded: 2016
Sector: Industrial AI | NDE | Inspection Automation

Founders: Daniel Raj David, Harikrishnan A S, Karthik R, Tarun Mishra, Prof. Krishnan Balasubramanian, Prof. Prabhu Rajagopal

Detect Technologies develops AI-driven inspection and monitoring solutions that integrate sensors, drones, and computer vision to automate industrial safety and asset monitoring.

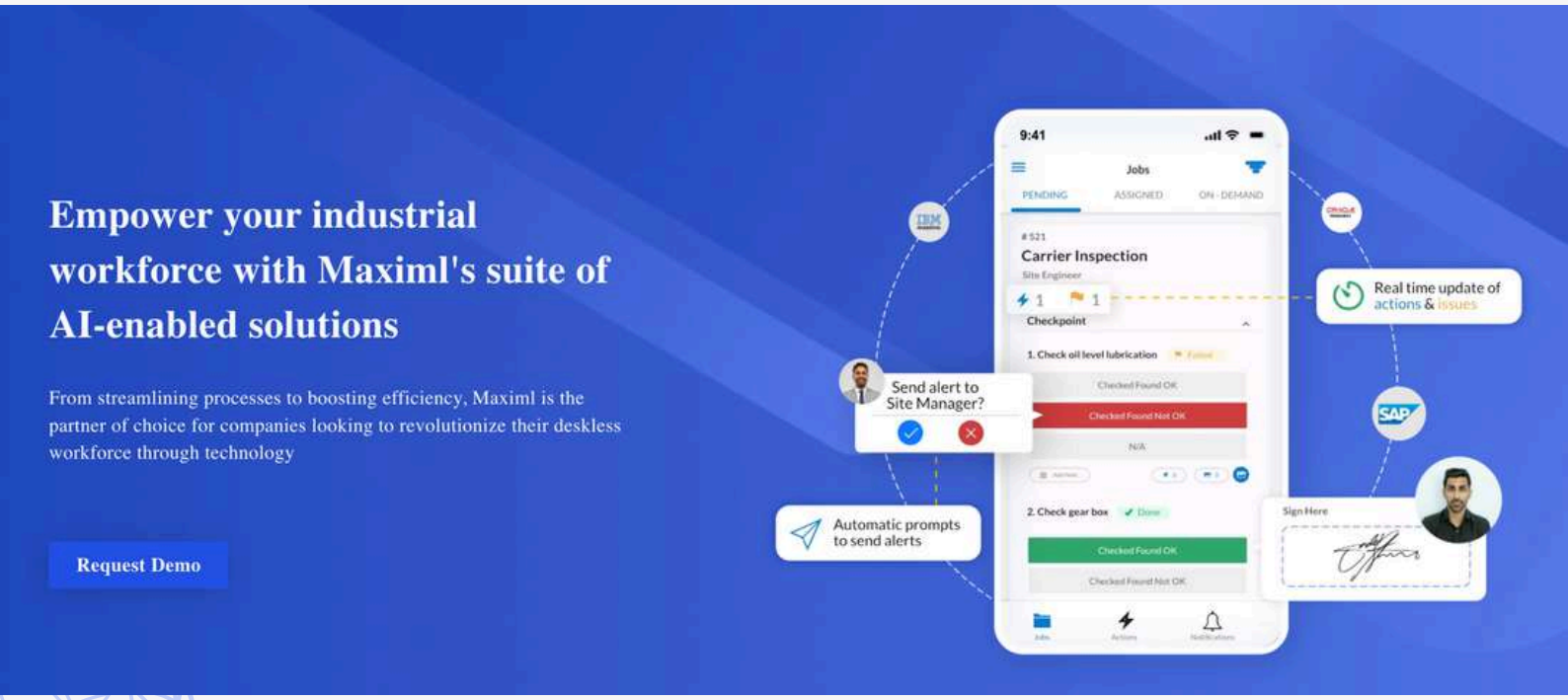
Core Products

- T-PULSE: AI platform for safety monitoring and workflow tracking using computer vision
- G-PULSE: Ultrasonic system for real-time pipeline and tank monitoring

NOCTUA: Drone-based inspection system for hazardous industrial environments

https://detecttechnologies.com/

Maximal Labs



Founded: 2016
Sector: Industrial SaaS | Digital Workflows

Maximal Labs builds low-code, mobile-first platforms to digitize paper-based workflows in industrial operations. Its solutions enable real-time collaboration between field teams and management, improving efficiency in maintenance, shutdowns, and daily operations.

Core Products

- Connected Worker Platform: Digital workflows and real-time data capture for field operations
- Maximal STO: Platform for managing shutdowns, turnarounds, and outages
- Control of Work (CoW): Digital permit-to-work system for safety and compliance

https://maximl.com/

SOLINAS

Founded: 2018
Sector: Robotics | Water & Sanitation
Founders:
Divanshu Kumar,
Moinak Banerjee,
Prof. Prabhu Rajagopal,
Prof. Krishnan Balasubramanian,

Solinas develops robotic systems and AI-powered software to inspect, clean, and manage underground water and sewer pipelines. Their technology replaces hazardous human intervention in confined spaces like septic tanks and manholes while providing data-driven insights to prevent water contamination and infrastructure failure.

CORE PRODUCTS

ENDOBOT A pipeline inspection robot that navigates narrow water and sewer lines to detect leaks, cracks, and blockages. It uses high-resolution cameras and sensors to provide precise location data for targeted repairs, reducing water loss.

HOMOSEP India's first robotic septic tank cleaner designed to eliminate manual scavenging by liquefying and extracting sludge. It replaces hazardous human entry with a mechanized blade system, ensuring safety and dignity for sanitation workers.

SWASTH AI An AI-driven software platform that analyzes inspection footage to automatically identify and grade pipeline defects. It digitizes underground assets, allowing municipalities to move from reactive repairs to data-backed preventive maintenance

https://solinas.in/

DHVANI ANALYTIC INTELLIGENCE

FOUNDED: 2019
SECTOR: AI | NDT | INDUSTRIAL ANALYTICS

FOUNDERS: SUJATHA CHAKRAVARTHY, PROF. KRISHNAN BALASUBRAMANIAN, K. S. VENKATARAMAN, PADMA PURUSHOTHAMAN

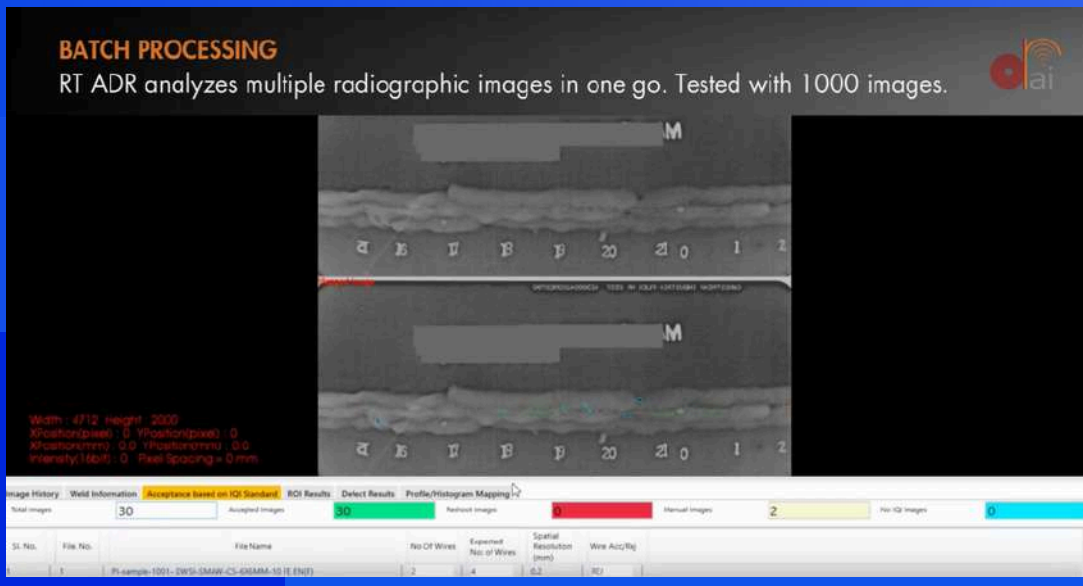
Dhvani AI develops software-driven solutions for automating NDT data analysis and industrial workflows. Using AI, it reduces human dependency, improves inspection accuracy, and enables real-time monitoring of safety and productivity in industrial environments.

Core Products

Process AI: Automates document processing and compliance reporting

Product AI (Inspection QA): AI-driven radiography analysis for defect detection

People AI (PixIQ): Vision-based system for safety monitoring and workforce analytics



https://www.dhvaniai.com/

DHVANI INSPECTION TECHNOLOGIES

Founded: 2019
Sector: NDT | Ultrasonics | Asset Integrity

Founders: Krishnan Balasubramanian, Sujatha Chakravarthy

Dhvani Inspection Technologies specializes in advanced ultrasonic guided wave inspection solutions for detecting hidden corrosion in pipelines and storage tanks without requiring shutdown. Their technology enables long-range inspection, allowing operators to identify defects in hard-to-access areas such as pipe supports and insulated sections. By providing accurate and real-time insights into asset condition, their solutions help improve safety, reduce downtime, and enable cost-effective maintenance of critical industrial infrastructure.

Core Products

- HOMC CUPS: Corrosion detection at pipe supports (hard-to-access areas)
- HOMC TAPS: Tank annular plate inspection system
- HOMC Technology: Long-range guided wave inspection for pipelines and structures

https://www.dhvani-inspection.com/

XYMA ANALYTICS
Sensor Driven Decisions

XYMA ANALYTICS PRIVATE LIMITED.

Founded: 2019
Sector: Industrial IoT | Sensors | Deep-Tech Manufacturing

Founders: Nishanth Raja, Aswin Kumar Kathirvel, Prof. Krishnan Balasubramanian, Prof. Prabhu Rajagopal

XYMA Analytics is a deep-tech startup spun out of the Centre for Non-Destructive Evaluation (CNDE) at IIT Madras. The company develops patented ultrasonic waveguide-based sensors and Industrial IoT solutions for monitoring high-temperature industrial processes. Its technology enables accurate multi-point temperature sensing and real-time data analytics to improve plant safety, asset life, and operational efficiency in industries such as refineries, power plants, and manufacturing.

Core Product

µTMaps: Multi-point temperature sensing system for high-temperature industrial processes

https://www.xyma.in/

Plenome Technologies.

Founded: 23 April 2023
Sector: Healthcare

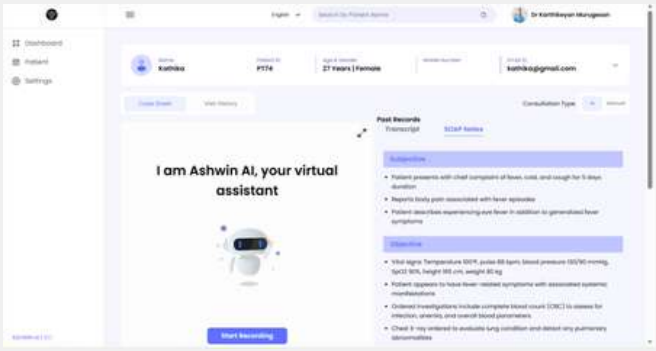
Founders:
Prof. Prabhu Rajagopal – Founder & Chairman
Vijayaraja Rathinasamy – Co-Founder & COO
Anirudh Varna – Co-Founder & CTO

Plenome is an IIT Madras-incubated startup emerging from the Automation and Data Engineering (ADE) group at CNDE. It focuses on building Clinical AI infrastructure to address the fragmentation of healthcare data through secure, federated, and interoperable systems.

By leveraging AI, blockchain, and clinical data, Plenome enables privacy-preserving data exchange, improved clinical decision-making, and enhanced patient outcomes. Its solutions are also applicable to other regulated sectors such as energy, education, defense, and legal systems.

Core Products & Solutions

- Ashwin AI: Converts clinical conversations into FHIR-compliant EMRs
- Aayush App: Enables patients to own and manage their health records
- Med-Hub: Smart POS+ system for streamlined outpatient consultations
- Organease: AI and blockchain-based organ transplant management (deployed with Govt. of Tamil Nadu)
- Analytics Suite: Integrated platform for clinical and operational decision-making



https://plenome.com

FOLIUM SENSING
INFINITE POSSIBILITIES

Folium Sensing Pvt. Ltd.

Sector: Deep-Tech | Fiber-Optic Sensing

About

Folium Sensing is an IIT Madras-incubated deep-tech startup emerging from CNDE and IITM Pravartak Technologies Foundation. It focuses on fiber-optic sensing systems for industrial and infrastructure applications.

The company develops distributed fiber optic sensing (DFOS) solutions capable of monitoring vibration, temperature, strain, and acoustic signals over long distances. These technologies enable real-time detection of faults, improve safety, and enhance operational efficiency across sectors such as infrastructure, energy, and telecom.

Headquartered at IIT Madras Research Park, Folium Sensing combines advanced research with industry collaboration to deliver scalable, next-generation sensing solutions.

Founders:
Balaji Srinivasan
Sanidhya Chaturvedi
Krishnan Balasubramanian
Venkatesh Varadhan
Sector: Deep-Tech | Fiber-Optic Sensing.

https://foliumsensing.com/

Raillabs Private Limited

Founded: 2024
Sector: Deep-Tech | Railway Safety | Industrial AI | NDE

Founders:
Prof. Krishnan Balasubramanian
Rajesh Rathi
Sumit Anand

Raillabs Private Limited is an IIT Madras-incubated deep-tech startup focused on enhancing railway safety through AI, robotics, and non-destructive evaluation (NDE) technologies. The company develops autonomous inspection and predictive maintenance solutions to detect defects in railway tracks and rolling stock.
By enabling early fault detection, Raillabs aims to improve safety, reliability, and maintenance efficiency across railway networks.

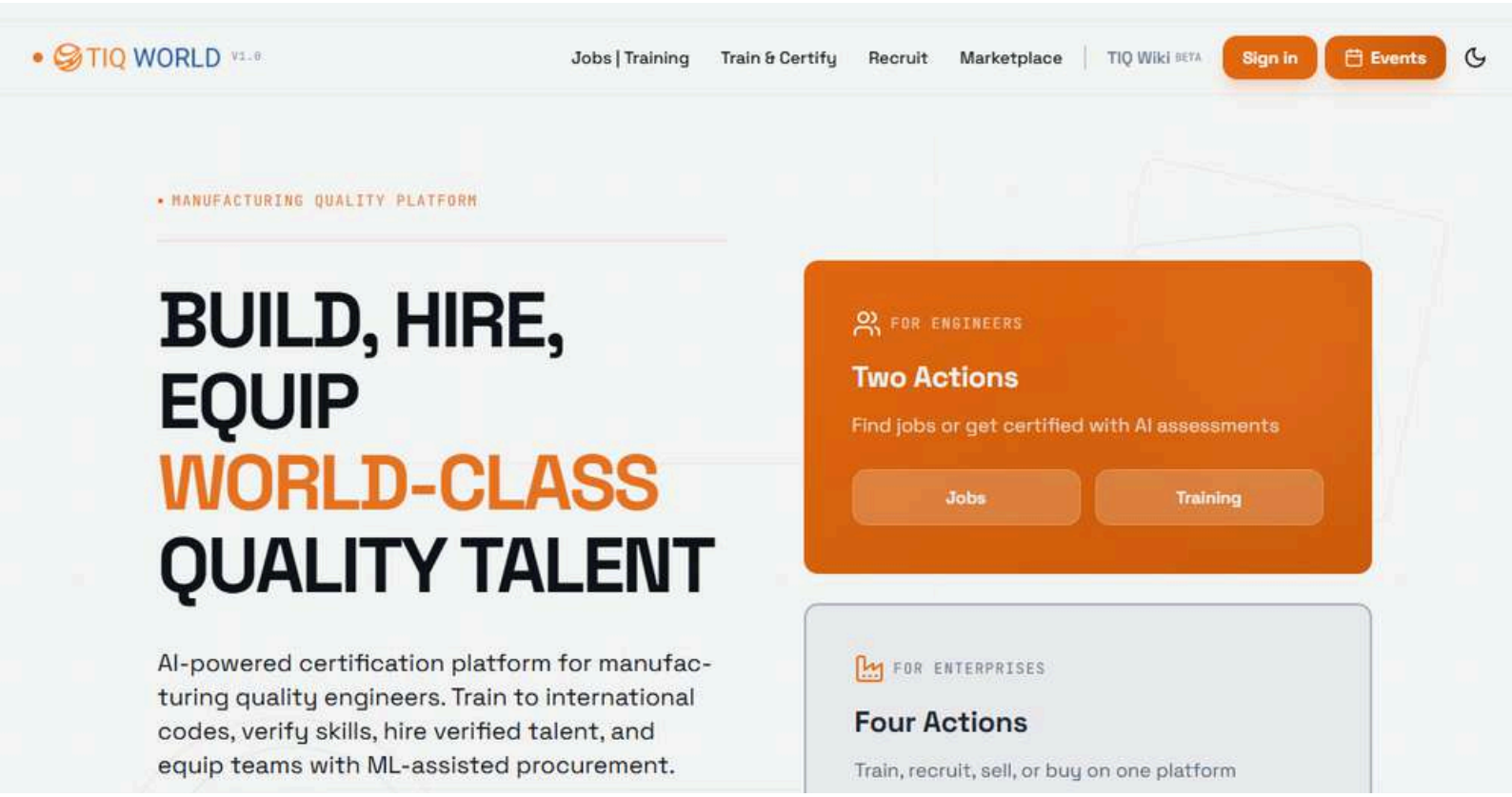
Core Products & Solutions

ARISTA (Autonomous Rail Inspection System): Robotic system using ultrasonic sensing and AI analytics for real-time rail defect detection

ChakryVue (Wheel Shelling Prediction System):

AI-driven platform for predictive maintenance of rolling stock, reducing failures and operational costs
If you want, I can convert this into a startup infographic card (matching your Plenome/IPR style).

TIQWorld Private Ltd.



Founders:
Srijan Tiwari
Rajan Ananthanarayanan
Krishnan Balasubramanian
Industry/Sector: Manufacturing Quality, Digitalisation, AI Assistance in Inspections, Digital Ecosystem.

TIQWorld.com where TIQ stands for Testing, Inspection & Quality; is a digital ecosystem for the World of Manufacturing Quality. We're born out of CNDE Lab, IIT Madras and now incubated at IIT Madras Incubation Cell, IITM Research Park, Chennai.

We are eliminating fragmentations in Training & Recruitment of the professionals/freelancers, Procurement of Tools, Devices and Consumables and Building Intelligent Systems for Inspection Reporting

Core Products / Services:

www.tiqworld.com : Digital Infrastructure for Manufacturing Quality Ecosystems powered by AI

https://tiqworld.com

TIQ World offers an integrated platform combining industry-led NDT training and certifications, a professional talent marketplace, an inspection equipment procurement hub, and an AI-powered knowledge assistant — purpose-built for the manufacturing quality ecosystem. Notably, TIQ World is the only Indian startup represented on the global NDT stage in Berlin (2025), with recognition spanning the University of Luxembourg, ICNDT Bengaluru, NDE 2025 Mumbai, and a direct pitch to India's Education Minister.

RESEARCH EXCELLENCE & RECOGNITION

IIT Madras Professor Krishnan Balasubramanian Elected IAS Fellow

IIT Madras congratulates Prof. Krishnan Balasubramanian on being elected Fellow of the Indian Academy of Sciences (IAS). This prestigious honour recognises his outstanding contributions to Non-Destructive Testing (NDT) and scientific research.

His pioneering work and leadership at the Centre for Non-Destructive Evaluation (CNDE) have advanced engineering practices and inspired impactful research.
The IIT Madras community extends its best wishes for his continued success.

Prestigious Recognition in NDE Research

Prof. Krishnan Balasubramanian, Head of CNDE, has been honoured with the prestigious J.C. Bose Grant (formerly J.C. Bose Fellowship) by the Anusandhan National Research Foundation (ANRF), one of India's highest recognitions for sustained scientific excellence. He has also been elected as a Fellow of the Indian Academy of Sciences (IAS), recognising his significant contributions to Non-Destructive Testing (NDT) and engineering research.

IIT Madras Professor Prabhu Rajagopal Honoured as Rashtriya Vigyan Puraskar

We are thrilled to share that Prof. Prabhu Rajagopal has been honored with the prestigious Rashtriya Vigyan Puraskar: Vigyan Yuva Shanti Swarup Bhatnagar Award. The award was presented by President Droupadi Murmu at the Rashtrapati Bhavan as part of the 2024 Rashtriya
Vigyan Puraskar ceremony.This recognition is a testament to Prof. Prabhu Rajagopal's outstanding contributions to Technology and Innovation. We are incredibly proud of this remarkable achievement!

Nanjangud G. Viswanath Swabhanu Leadership Chair

IIT Madras established the Swabhanu Leadership Chair, a unique professorship that recognizes excellence in both academic and administrative leadership. Instituted by Dr. Amritur V. Anil Kumar, the Chair honors the legacy of Nanjangud G. Viswanath.
The inaugural recipient is Prof. Prabhu Rajagopal (Department of Mechanical Engineering), recognized for his contributions to research, innovation, and institutional leadership, including his role at the IIT Madras Zanzibar campus.
"Swabhanu," meaning self-radiant, reflects the vision of nurturing leaders who independently drive transformative impact in education, research, and innovation.

Institute Research and Development Award (IRDA)

Prof. Prabhu Rajagopal has been awarded the Institute Research and Development Award (IRDA) 2025 in the Mid-Career category. The award was presented in the presence of V. Kamakoti and Shivkumar Kalyanaraman.

This recognition highlights his sustained contributions to Non-Destructive Evaluation (NDE) research, building on his earlier IRDA (Early Career) award in 2019.

Recognition for Societal Impact & Innovation

Prof. Prabhu Rajagopal has been awarded the Mukta Pai Faculty Fellowship, recognising his outstanding contributions that combine technical excellence with strong societal impact.

His pioneering initiatives include HomoSEP, a robotic system enhancing sanitation safety, and BlockTrack, a secure platform for healthcare record management. These innovations reflect his commitment to solving critical real-world challenges through engineering.
This fellowship highlights the role of research in driving meaningful change and celebrates the impactful work emerging from IIT Madras.

Prestigious Fellowship Recognition

Prof. Prabhu Rajagopal, Deputy Head of CNDE, has been elected as a Fellow of the Indian National Academy of Engineering (INAE), 2025. This distinguished honour recognises his impactful research, engineering excellence, and contributions toward bridging academia and industry.
This recognition reflects CNDE's strong culture of innovation, mentorship, and impact-driven research, inspiring the community to continue advancing the frontiers of science and engineering.

Expanding CNDE's Footprint: VISITS & RECOGNITIONS

Industry & Strategic Collaborations

December 2024
ZF Group Visit (Automotive Sector)

CNDE hosted ZF Group to explore NDE sensor integration in automotive systems. Discussions focused on performance monitoring and advanced sensing applications, strengthening industry collaboration

January 2025
Indian Armed Forces Delegation Visit

Senior defence leadership visited CNDE to understand applications of NDE and Structural Health Monitoring (SHM) in defence systems. The interaction highlighted CNDE's contributions to national missions.

February 2025
ISRO Scientists Visit (Human Space Flight Centre)

Scientists from ISRO engaged with CNDE's work on ultrasonic waveguides and fiber optic sensing, relevant for extreme and space environments.

Industry Interaction with Dr. Kannan (Ex-IOCL)

Discussions focused on pipeline integrity, failure analysis, and industry collaboration, including NCNDE initiatives and startup ecosystem insights.

April 2025

Airbus Visit (Aerospace Collaboration)
Airbus leadership engaged with CNDE on research initiatives and startup ecosystem, focusing on aerospace applications.

TDK Corporation Visit
Collaboration discussions on optical fiber sensing technologies (DAS, DTS, DSS) and industrial monitoring solutions.

Vel Tech University Visit (Academic Collaboration)
Interaction focused on research partnerships, student engagement, and NCNDE membership opportunities.

ANSA Training & QA (Industry Training Collaboration)
Discussions on NDE training, certification, and capacity building initiatives.

Rajalakshmi Engineering College Visit
Focus on student internships, academic collaboration, and exposure to advanced NDT techniques.

Technical Seminar — Dr. Abhishek Saini
Seminar on AI-integrated ultrasonic NDE, showcasing advanced imaging and next-generation inspection technologies.

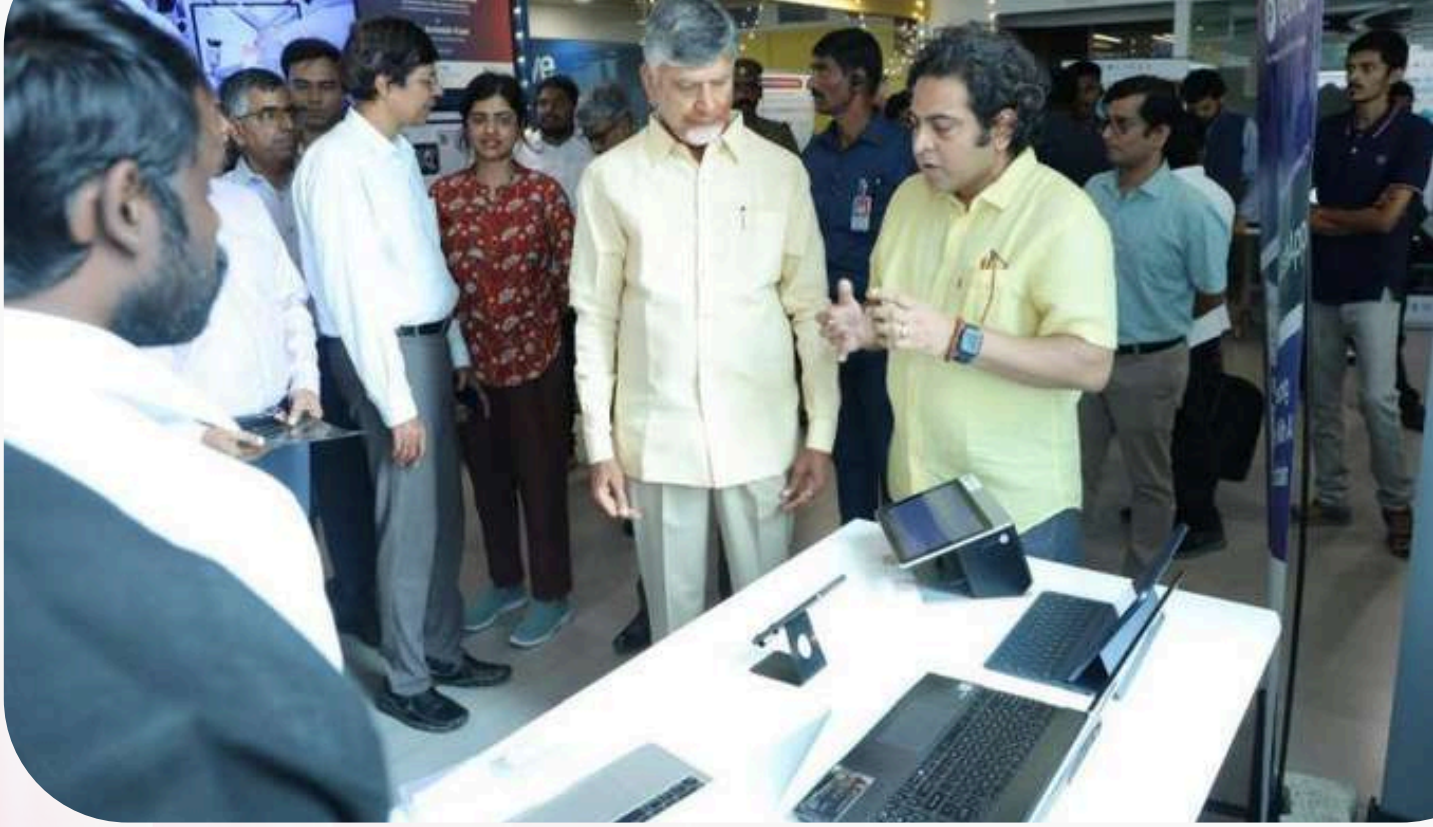
300+

visitors/year

Startups Recognition

Rail Labs Showcases Railway Safety Innovations to Hon'ble Minister Shri Ashwini Vaishnaw

CNDE Startups Pitch to Hon'ble Education Minister of India: TIQWorld, Rail Labs, Folium Sensing



Showcasing work on DLT-AI to the Hon'ble CM – Plenome at Andhra Pradesh

Showcasing Optical Fiber Sensing – Folium Sensing Hosts Hon'ble CM

Solinas Integrity: Robotic Solutions Transforming India's Sanitation Landscape

XYMA Analytics Wins Top Innovation Honor at Southeast Asia Summit

DRIVING IMPACT THROUGH OUTREACH

DECADE OF IMPACT – CNDE & NAIROBI

CNDE marked over ten years of impactful collaboration with the University of Nairobi, Kenya. Through faculty exchanges, joint research, and capacity-building efforts, this partnership has played a vital role in strengthening NDE education and research in East Africa. The milestone reaffirms CNDE's commitment to global outreach and sustainable scientific development.

PUSHING BOUNDARIES IN ULTRASONICS – CNDE AT NNETRA

CNDE, IIT Madras, a key participant in the NNetRA project funded by MeitY, has developed India's first acoustic microscopy device with Lamb wave scanning led by Prof. Krishnan Balasubramanian, in collaboration with Center for NEMS and Nano Photonics (CNNP).

In the second phase, Prof. Prabhu Rajagopal's team achieved world-record resolution in ultrasonics using metamaterials, resulting in multiple IP filings and commercialisation via Dhvani R&D Solutions Pvt. Ltd.

Visioning India's Tech-Driven Future at CII Yi Summit 2025

The recent CII YiFi Entrepreneurship Summit 2025 convened leading thinkers to chart India's technological trajectory toward 2030. This pivotal discussion examined how deep-tech innovation and digital transformation can propel India's emergence as a global technology leader while fostering inclusive growth.
Distinguished panelists including Prof. Prabhu Rajagopal (IIT Madras) and Srinath Ravichandran (Agnikul Cosmos) explored critical themes, scaling innovation from research labs to real-world impact, empowering entrepreneurs beyond metropolitan hubs, and positioning India at the forefront of technological advancement.

DIGITAL RADIOGRAPHY TRAINING PROGRAM AT CNDE- FLAGSHIP NCNDE EVENT

NCNDE conducted a Digital Radiography Training Program at IIT Madras (Sept 1–5, 2025), with participation from leading organizations including DRDO, Reliance, L&T, Tata, and TÜV Rheinland.

The program covered fundamentals and applications of Digital Detector Arrays (DDA) and Computed Radiography, combining theory with hands-on training.
Supported by industry partners, the initiative highlighted strong industry collaboration and received excellent feedback from participants.

ISNT–CNDE COMPUTED RADIOGRAPHY TRAINING

ISNT and CNDE jointly conducted a two-day training program on computed radiography for weld inspection at Reliance Industries (Jamnagar).

The program covered fundamentals, image quality, processing techniques, and industry standards (ISO, ASTM, ASME), supporting RIL's transition from conventional to digital radiography.With participation from 25+ engineers, the training was well received and reinforced strong industry–academia collaboration.

IIT MADRAS AT Y COMBINATOR AI STARTUP SCHOOL

Mr. Nimesh Cheedella from IIT Madras was selected for the prestigious Y Combinator AI Startup School (June 2024, San Francisco), representing the institute on a global platform.
With a highly competitive selection rate (~7.5%), his participation highlights IIT Madras' growing presence in the global AI ecosystem.
The program enabled interaction with leading tech leaders and provided opportunities to present innovative ideas, strengthening global exposure and collaboration.

CNDE AT DGZFP CONFERENCE, BERLIN

Srijan Tiwari, Research Scholar at CNDE and Co-founder of TIQ World, represented IIT Madras at the DGZfP Annual Conference, Berlin, a leading global platform in NDT.
As the only Indian presenter, he showcased CNDE's NDE 4.0 vision, focusing on AI-driven inspection, digitalisation, and intelligent decision-making systems.
His work highlights India's growing leadership in advanced NDT and reinforces CNDE's role in driving next-generation inspection technologies globally.

2001-26
Student Roster

Ph.D. Students Supervised by Prof. Krishnan Balasubramanian

No.	Name	Year	Department
1	Vimal V. Shah	1996	Engineering
2	Ji Yuyin	1996	Engineering
3	Richard Dove	1998	Engineering
4	G. Baskaran	2005	Applied Mechanics
5	L. Satyanarayan	2007	Mechanical Engineering
6	S. Narayana Jammalamadakal	2008	Physics
7	Madhu Shankar	2009	Mathematics
8	S.K. Nath	2009	Mechanical Engineering
9	Vishnu Vardhan J.	2009	Mechanical Engineering
10	N. Biju	2010	Mechanical Engineering
11	Kathirvel Thyagarajan	2011	Mechanical Engineering
12	R. Dhayalan	2011	Mechanical Engineering
13	Ramadasu Chinnamsetti	2012	Mechanical Engineering
14	Janardhan Padiyar	2014	Mechanical Engineering
15	S.K. Sathishkumar	2014	Mechanical Engineering
16	Abhilasha Ramdhas	2014	Mechanical Engineering
17	Gopal Gantala	2015	Mechanical Engineering
18	Mini Sahadevan	2016	Mechanical Engineering
19	Sai Makkireddi	2018	Mechanical Engineering
20	Suresh P.	2018	Mechanical Engineering

Ph.D. Students Supervised by Prof. Krishnan Balasubramanian

21	Mini R.S.	2018	Mechanical Engineering
22	Amireddy Kiran Kumar	2018	Mechanical Engineering
23	Sai Makireddi	2019	Mechanical Engineering
24	Rabi Sankar Panda	2019	Mechanical Engineering
25	Avijit Kr. Metya	2019	Mechanical Engineering
26	Shivaprasad S.	2020	Mechanical Engineering
27	Nitin Vengara Puthiyaveettil	2021	Mechanical Engineering
28	Dileep Koodalil	2021	Mechanical Engineering
29	Geo Davis	2022	Mechanical Engineering
30	S.R. Sandeep Kumar	2023	Mechanical Engineering
31	Suresh Nived	2023	Mechanical Engineering
32	Thulasiram Gantala	2023	Mechanical Engineering
33	Siddarth Shankar	2023	Mechanical Engineering
34	Vetrivel Sankar	2023	Physics
35	Debbadutta Setty	2023	Mechanical Engineering
36	Renil Thomas K.	2023	Mechanical Engineering
37	V.K. Krishnadas	2024	Mechanical Engineering

M.S. Students Supervised by Prof. Krishnan Balasubramanian

No.	Name	Year	Department
1	Dana Ladnier	1992	Engineering Mechanics
2	Krishnan Iyer	1992	Engineering Mechanics
3	Rani Sullivan	1993	Aerospace Engineering
4	S. Kanthikannan	1994	Engineering Mechanics
5	Satyanarayana Alluri	1994	Engineering Mechanics
6	Sean Whitney	1994	Aerospace Engineering
7	Srinivas Bolla	1994	Engineering Mechanics
8	Chandra Abesingha	1994	Civil Engineering
9	Saravanan Lakshman	1995	Engineering Mechanics
10	Balamurali Meduri	1996	Civil Engineering
11	Kasturi Perinkulam	1996	Engineering Mechanics
12	Praveen Nidumolu	1997	Engineering Mechanics
13	Trey Givens III	1997	Aerospace Engineering
14	Naveen S. Rao	1997	Engineering Mechanics
15	Atanu Pal	1998	Engineering Mechanics
16	Santosh Kumar	1998	Engineering Mechanics
17	Praveen Nidumolu	1999	Engineering Mechanics
18	S.S.S. Reddy	2003	Mechanical Engineering
19	Mahadev Prasad	2003	Mechanical Engineering
20	Ezhil Jothinathan	2004	Metallurgical Engineering
21	Krishnaprasad M.	2005	Mechanical Engineering
22	K. Shivaraj	2006	Mechanical Engineering
23	Padmakumar Pullith	2006	Mechanical Engineering

M.S. Students Supervised by Prof. Krishnan Balasubramanian

No.	Name	Year	Department
24	V.V.S. Jayarao	2007	Mechanical Engineering
25	V.S.K. Prasad	2007	Mechanical Engineering
26	Haraprasad K.	2008	Mechanical Engineering
27	Vageshwar Akula	2008	Mechanical Engineering
28	Muneer Mohamed	2009	Mechanical Engineering
29	Jitendra S. Valluri	2009	Mechanical Engineering
30	Chandrashekar Jayaraman	2009	Mechanical Engineering
31	S. Alavudeen	2010	Mechanical Engineering
32	U. Sreedhar	2011	Mechanical Engineering
33	MR. Tejeswini	2013	Mechanical Engineering
34	Vidya Joshi	2013	Mechanical Engineering
35	P. Sreedhar	2013	Mechanical Engineering
36	MN. Libin	2014	Mechanical Engineering
37	L. Balaji	2015	Mechanical Engineering
38	Deepesh Vimalan	2015	Mechanical Engineering
39	M. Prabhakaran	2015	Mechanical Engineering
40	Shah Harsh Jagdishbhai	2017	Mechanical Engineering

M.S. Students Supervised by Prof. Krishnan Balasubramanian

41	Mahesh Raja	2017	Engineering Design
42	Pabitro Ray	2017	Interdisciplinary Engineering
43	Antony Jacob Ashish	2018	Mechanical Engineering
44	Chaitanya Bakre	2018	Mechanical Engineering
45	Shah Harsh Jagdishbhai	2019	Mechanical Engineering
46	Tibin Thomas	2019	Mechanical Engineering
47	Kota Sri Harsha Reddy	2020	Mechanical Engineering
48	Aditya Chillukuri	2021	Mechanical Engineering
49	Sayantan Ghosh	2021	Mechanical Engineering
50	Guru Prasad Sahu	2022	Mechanical Engineering
51	Ainulla Khan	2023	Mechanical Engineering
52	Parambeer Singh Negi	2023	Mechanical Engineering
53	Jayakumar Fultariya	2023	Mechanical Engineering
54	Anoop Upendran	2023	Mechanical Engineering
55	Renjith P.	2023	Mechanical Engineering
56	P.L. Sudarshan	2024	Mechanical Engineering
57	Rajan H. Chaudhary	2024	Mechanical Engineering
58	A.V. Sachinlal	2024	Mechanical Engineering

Post-Doctoral Associates by Prof. Krishnan Balasubramanian

No.	Name	Country	Year
1	Bruce Maxfield	USA	2004-2010
2	C.V. Krishnamurthy		2002-2010
3	Benoit Puel	France	2007-2008
4	Theobald Fuchs	Germany	2010-2011
5	Elankumaran Kannan		2004-2008
6	Samuel Hill	UK	2013-2014
7	U. Sreedhar		2010-2012, 2015-2018
8	Mohamed Subair		2019-2021
9	Rabi Sankar Panda		2019-2023
10	Chandan Datta		2022-2023
11	Debadatta Sethy		2023-2024

PHD Graduate Supervised by Prof. Prabhu Rajagopal

No.	Name	Company
1	Mohamed Subair	Iowa state
2	Rabi Sankar Panda	Xyma
3	Geo Davis	Strathclyde
4	Suresh	NITW
5	Sandeep Kumar	Eindhoven
6	Kiran Kumar Amireddy	CBIT
7	Jagadeeshwar	Fraunfofer
8	Manjunath	SIT
9	Nithin	VTT Finland
10	Vishakh S Kumar	Rainault
11	Dileep	Ark2Tech
12	Vineeth	DRDO
13	Wilson Kairuh	Nairobi
14	Johnson	Nairobi
15	Saurob Gupta	VIT

M.S. Students Supervised by Prof. Prabhu Rajagopal

No.	Name	Company
1	Aishwarya Kumar	Tata Steel
2	Neha Arora	Bajaj Auto
3	Bhavesh Narayani	Nirbhav Automation
4	Anvrag	Manpower
5	Roshan Pattanayak	RIL
6	Harsh Shah	AIRBUS
7	Sri Harsha	Adikavi Nannaya University
8	Santhosh	Planys
9	Antony Jacob Ashish	Planys
10	C Pradeep	Bajaj Auto
11	Harsh Maheswari	LAM Research
12	Anmol Shrivastava	LAM Research
13	Karthikeyan	BigThinkCode
14	Prabakaran	Apple
15	Aditya Chilkuri	
16	Chaitanya Bakre	Intel
17	Bhupesh verma	GE
18	Sheri Prashanth Reddy	GE Aerospace
19	Srikanth	LAM Research
20	Sai Teja	CSIR
21	Kamal	Tiger Analytics
22	Ramesh	BioRad Medisys
23	Sai Adithya Raman Kuchibatla	IIT Hyderabad

Current PHD Students Supervised by Prof. Prabhu Rajagopal

No.	Name	Stream
1	Bhaskar Kumar	Quantum Phononics
2	Amrita P	Quantum machine learning
3	Loheshwaran Chandran	Acoustic, meta materials
4	Mohammed Ali	Robotic Pipeline Inspection Using Guided Wave

Current students in MS Supervised by Prof. Prabhu Rajagopal

No.	Name	Stream
1	Amit Jain	Robotic foundation models
2	Gajanan	wave propagation in viscoelastic materials

Current students in MS Entrepreneurship Supervised by Prof. Prabhu Rajagopal

No.	Name	Stream
1	Vijayaraja R	Blockchain for healthcare
2	Mahalakshmi S	Automation
3	Shrijayanthi	AI for document processing
4	Gokula Vishnu Vimalakriti Damodaran	Humanoid robots

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