CENTRE FOR NON-DESTRUCTIVE EVALUATION
INDIAN INSTITUTE OF TECHNOLOGY MADRAS

NEWS-LETTER

NDE VARTIKA | JAN - MAR, 2026

Prof. Prabhu Rajagopal Appointed Director-in-Charge and Dean at IIT Madras Zanzibar

Prof. Prabhu Rajagopal

PROFESSOR AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

The Centre for Non-Destructive Evaluation (CNDE) is proud to share that Prabhu Rajagopal has been appointed as the Director-in-Charge and Dean (School of Engineering & Science) at the IIT Madras Zanzibar Campus. This prestigious appointment reflects his exceptional leadership, academic excellence, and significant contributions to research, innovation, and education in the field of Non-Destructive Evaluation (NDE).

Over the years, Prof. Prabhu Rajagopal has played a pivotal role in advancing research and technology development at the Centre for Non-Destructive Evaluation, particularly in areas related to ultrasonics, structural health monitoring, and next-generation NDE technologies. He has also been actively involved in mentoring and supporting several deep-tech startups, contributing to the growth of the innovation and entrepreneurship ecosystem associated with IIT Madras.

His appointment to this leadership role at the Zanzibar campus marks an important milestone and reflects the growing global presence of IIT Madras in engineering education, research, and international collaboration. The CNDE community takes great pride in this achievement and looks forward to his continued leadership and contributions in strengthening academic programs, research initiatives, and global partnerships.

The entire CNDE family extends its heartfelt congratulations and best wishes to Prof. Prabhu Rajagopal as he takes on this new and inspiring role.

Strengthening Research Excellence: Prof. Abhishek Saini Joins CNDE

Prof. Abhishek Saini

PROFESSOR AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

We are delighted to welcome Dr. Abhishek Saini to the Centre for Non-Destructive Evaluation at Indian Institute of Technology Madras as an Assistant Professor in the Department of Mechanical Engineering.

Dr. Saini brings with him a wealth of experience spanning academia and industry, having previously worked at Razer and conducted advanced research at Los Alamos National Laboratory and the Rolls-Royce@NTU Corporate Laboratory. He earned his Ph.D. from Nanyang Technological University.

His research interests lie at the intersection of advanced sensing, wave physics, imaging, and artificial intelligence, with a strong focus on Non-Destructive Evaluation (NDE) and Structural Health Monitoring (SHM). His work aims to develop innovative solutions for defect detection, material characterization, predictive maintenance, and next-generation inspection systems.

Prof. Saini's presence will further strengthen CNDE's mission of fostering high-impact research, industry-relevant innovation, and interdisciplinary collaboration. The addition of Prof. Saini to the CNDE faculty community also reflects the centre's continued commitment to building a strong academic environment that nurtures young researchers, encourages collaborative research, and develops future leaders in the field of non-destructive evaluation and structural health monitoring.

The CNDE community looks forward with great enthusiasm to his contributions in advancing cutting-edge research, mentoring students and researchers, and strengthening collaborations with industry and research institutions worldwide. We warmly welcome Prof. Abhishek Saini to CNDE and wish him every success in his new role.

Strengthening Research Excellence: Prof. Vivek Samu Joins CNDE

Prof. Vivek Samu

PROFESSOR AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

The Centre for Non-Destructive Evaluation (CNDE) warmly welcomes Dr. Vivek Samu. We are delighted to have him as part of the CNDE research community, and we look forward to his contributions to the growing interdisciplinary research initiatives of the laboratory.

Dr. Samu completed his B.Tech. from the National Institute of Technology (NIT) Trichy, and subsequently pursued his M.S. and Ph.D. from North Carolina State University, USA. Prior to joining IIT Madras, he served as an INSPIRE Faculty at the Indian Institute of Science (IISc), Bangalore, where he was actively involved in research related to Non-Destructive Evaluation and infrastructure monitoring.

His research focuses on Non-Destructive Evaluation (NDE) of civil infrastructure using wave propagation-based techniques. His work aims to enhance existing evaluation methods and develop new, simplified NDE methodologies for quality assurance and condition assessment of civil infrastructure. His research

integrates efficient computational modelling, optimal sensing strategies, automation, and inversion techniques for reliable structural health monitoring.

Dr. Samu's research interests include ultrasonic tomography of concrete structures, surface wave-based evaluation of pavements, and Non-Destructive Evaluation of pile foundations. His expertise aligns strongly with the research objectives of CNDE, particularly in the areas of imaging, signal processing, inverse problems, and structural health monitoring.

The CNDE laboratory looks forward to collaborative research, student mentorship, and the advancement of innovative Non-Destructive Evaluation technologies with his association. We extend our warmest welcome to Dr. Vivek Samu and wish him a successful and fulfilling journey at CNDE.

Leadership Meets Innovation: CNDE Welcomes Distinguished Advisors

The Centre for Non-Destructive Evaluation at Indian Institute of Technology Madras is pleased to welcome M. T. Shyamsunder Mandayam and Anil Kumar Das as Advisors to the Centre.

Dr. M. T. Shyamsunder Mandayam

ADVISOR AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

Dr. M. T. Shyamsunder Mandayam brings more than four decades of global leadership in non-destructive evaluation (NDE), inspection technologies, innovation, and digital transformation. His distinguished career includes key roles at Indira Gandhi Centre for Atomic Research and GE Research. Widely recognized for his pioneering contributions to advanced NDE technologies, NDE 4.0 frameworks, digital inspection ecosystems, and industry–academia collaboration, Dr. Mandayam has played a transformative role across multiple sectors including nuclear energy, aerospace, manufacturing, and heavy engineering.

Throughout his career, he has been deeply involved in driving innovation in inspection science, mentoring young researchers, and building collaborative technology platforms that bridge laboratory research with real-world industrial deployment. His guidance is expected to significantly strengthen CNDE's efforts in advanced research, technology translation, international collaborations, and capacity development in emerging NDE technologies.

Anil Kumar Das

ADVISOR AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

Anil Kumar Das, former Chief General Manager at NTPC NETRA, is a distinguished leader in the power sector and an experienced R&D strategist with more than three decades of expertise in non-destructive evaluation, Remaining Life Assessment (RLA), and metallurgical failure analysis. During his tenure at NETRA, he played a key role in advancing research programs aimed at improving the reliability, efficiency, and longevity of thermal power plants and associated infrastructure.

He was also a significant contributor to the Government of India's Advanced Ultra Supercritical Mission, an important national initiative focused on developing next-generation high-efficiency power generation technologies. His experience in large-scale plant health monitoring, advanced NDE deployment, materials evaluation, and national research programs will greatly enhance CNDE's industrial engagement and strategic initiatives, particularly in sectors such as energy, infrastructure, and heavy engineering.

The appointment of these distinguished experts reflects CNDE's commitment to strengthening its advisory leadership with individuals who bring deep technical knowledge, industry insight, and strategic vision. Their combined expertise spans research, industrial applications, national technology missions, and global innovation ecosystems, providing valuable guidance as CNDE continues to expand its role as a leading center for non-destructive evaluation and structural health monitoring.

With their mentorship and strategic inputs, CNDE aims to further accelerate interdisciplinary research, industry partnerships, startup incubation, and the translation of advanced NDE technologies into deployable solutions. Their presence will also support CNDE's efforts in addressing critical national challenges related to infrastructure safety, energy systems reliability, manufacturing quality, and next-generation inspection technologies.

CNDE warmly welcomes Dr. Mandayam and Shri Anil Kumar Das to the advisory team and looks forward to a meaningful and impactful association that will contribute to the Centre's continued growth as a global hub for innovation, research excellence, and industry collaboration in non-destructive evaluation and smart sensing technologies.

Strengthening Partnerships

Chevron Joins NCNDE as Platinum Member to Advance NDE Innovation

The National Consortium for Non-Destructive Evaluation (NCNDE) is proud to formally welcome Chevron as its newest Platinum Member. This significant partnership marks an important milestone in strengthening collaboration between leading industry partners and academic and research institutions in the field of Non-Destructive Evaluation (NDE).

Chevron's induction as a Platinum Member reflects a shared commitment to advancing excellence in NDE technologies, structural health monitoring, asset integrity management, and safety-critical inspection systems. Through this collaboration, NCNDE and Chevron aim to foster joint research initiatives, support technology development, and promote the practical implementation of advanced inspection and monitoring solutions for industrial applications.

This partnership is expected to open new opportunities for collaborative research projects, student engagement, technology transfer, and real-world problem solving in sectors such as oil and gas, energy, infrastructure, and manufacturing. By bringing together academic expertise and industry experience, the collaboration will contribute to the development of innovative, reliable, and cost-effective NDE solutions that address current and emerging industrial challenges.

NCNDE looks forward to a strong and productive association with Chevron, working together to drive innovation, enhance safety and reliability of industrial systems, and contribute to the growth of non-destructive evaluation technologies. This partnership represents another step forward in NCNDE's mission to build a strong industry–academia ecosystem and to shape a smarter, safer future through research, innovation, and collaboration.

SITAS Joins NCNDE as Silver Member to Advance NDE Innovation

The National Consortium for Non-Destructive Evaluation (NCNDE) is pleased to announce that SITAS has joined the consortium as a Silver Member. This association represents an important step toward strengthening collaboration between industry and academia in the field of Non-Destructive Evaluation (NDE) and structural health monitoring.

The partnership between NCNDE and SITAS is built on a shared vision of advancing excellence in NDE, fostering innovation, and supporting the adoption of advanced inspection and monitoring technologies across industries. Through this collaboration, both organizations aim to promote applied research, encourage knowledge exchange, and support the development of practical solutions to real-world industrial challenges.

As a Silver Member, SITAS will engage with NCNDE in collaborative research initiatives, technical knowledge sharing, student and researcher engagement, and the development of advanced NDE technologies and methodologies. This partnership is expected to contribute to the continuous growth of NDE practices, supporting safer and more reliable infrastructure and industrial systems at both national and global levels.

NCNDE looks forward to a strong and impactful collaboration with SITAS, working together to drive technological advancement, promote innovation, and contribute to the future of non-destructive evaluation and asset integrity management.

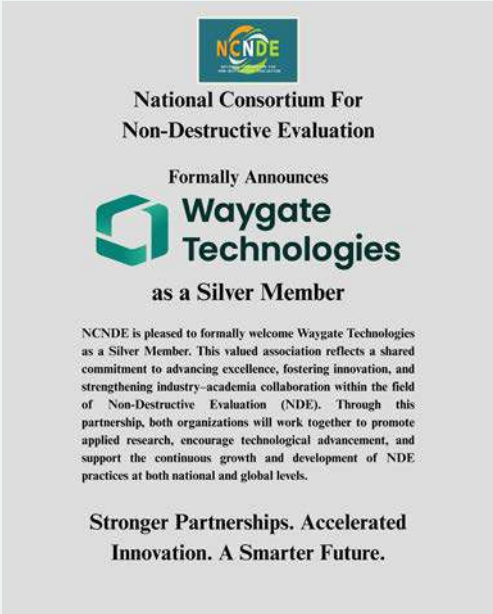
Expanding Industry-Academia Synergy: Waygate Technologies Joins NCNDE

The Centre for Non-Destructive Evaluation (CNDE) is pleased to announce that Waygate Technologies has joined the National Consortium for Non-Destructive Evaluation (NCNDE) as a Silver Member. This association marks an important milestone in strengthening industry–academia collaboration in the field of Non-Destructive Evaluation (NDE).

Waygate Technologies, a global leader in inspection solutions and advanced NDE technologies, brings extensive expertise in areas such as industrial radiography, computed tomography, ultrasonic testing, and digital inspection systems. Their inclusion in NCNDE is expected to further enhance collaborative research efforts and accelerate the development and deployment of innovative NDE solutions.

Through this partnership, CNDE and Waygate Technologies will work together to promote applied research, support technology development, and enable knowledge exchange between academia and industry. The collaboration will also create opportunities for joint projects, training programs, and the adoption of advanced inspection methodologies that address real-world industrial challenges.

This partnership aligns with NCNDE's vision of building a robust ecosystem that fosters innovation, drives technological advancements, and contributes to the continuous evolution of NDE practices at both national and global levels.



The CNDE community looks forward to a strong and impactful collaboration with Waygate Technologies, working together toward a future defined by stronger partnerships, accelerated innovation, and smarter engineering solutions.

Global Collaboration in Focus: MIT and NAMTECH Visit IIT

Representatives from Massachusetts Institute of Technology (USA) and New Age Makers Institute of Technology visited Indian Institute of Technology Madras to participate in a panel discussion with the MIT Department of Mechanical Engineering on the development of a new academic curriculum being jointly designed with NAMTECH. The visit formed part of an ongoing initiative to build globally aligned engineering education programs that integrate strong theoretical foundations with hands-on technological training and industry engagement.

The discussions centered on integrating global best practices with evolving industry requirements, strengthening academia industry partnerships, and shaping future-ready engineering education. The exchange of ideas highlighted the importance of collaborative approaches in preparing engineers for rapidly changing technological landscapes.

As part of the visit, the delegation toured the Centre for Non-Destructive Evaluation, where they were introduced to the centre's research facilities. The visit provided an excellent opportunity for knowledge exchange and highlighted the value of international collaboration in advancing both engineering education and research. CNDE expresses its sincere appreciation to John Liu, Licia Mastronardi, and Julie Diop for representing MIT, and Sridhar Kanukollu and Nandini Dasgupta for representing NAMTECH, for their valuable insights, engaging discussions, and productive interactions. The exchange of ideas further strengthened academic ties and opened avenues for future collaborations in curriculum development, joint research initiatives, and global engineering education programs.

Driving Smart Infrastructure Solutions Through CNDE Startup

The Centre for Non-Destructive Evaluation at Indian Institute of Technology Madras recently hosted Mr. Neeraj Saini and Ms. Meenakshi Singh from JMV Group, an organization actively involved in large-scale government and infrastructure initiatives, including projects with Indian Railways.

The meeting focused on exploring collaborative opportunities between CNDE-incubated startups Rail Labs and Folium Sensing Pvt Limited and JMV. Discussions centered on identifying potential project engagements, technology validation opportunities, and pilot deployments within real-world industrial and government operational environments.

During the interaction, both teams discussed the growing need for advanced sensing technologies, predictive maintenance tools, and intelligent inspection systems across critical infrastructure sectors such as railways, transportation corridors, and large-scale public assets. The meeting provided an opportunity to showcase the innovative technologies being developed by CNDE startups, particularly in the areas of structural health monitoring, sensor-enabled diagnostics, and data-driven asset management.

By combining JMV's strong industry network and project execution capabilities with the research-driven innovations emerging from CNDE, the collaboration aims to accelerate the transition of technologies from laboratory development to field implementation. Pilot projects in operational environments are expected to provide valuable feedback for refining these technologies, ensuring that they meet the reliability, scalability, and performance requirements of large infrastructure systems.

Such interactions highlight CNDE's role not only as a leading research center in non-destructive evaluation and structural health monitoring, but also as a vibrant innovation and startup ecosystem that nurtures technology commercialization. Through its incubation initiatives, CNDE continues to support startups in transforming cutting-edge research into practical solutions that address pressing industrial challenges.

The visit also opened discussions on future joint initiatives, including technology demonstrations, collaborative R&D activities, and potential integration of sensing solutions into infrastructure monitoring programs. These partnerships are essential for building sustainable pathways that enable academic innovations to reach industry and society at scale.

CNDE remains proud to foster such collaborations that strengthen the industry–academia interface, empower emerging startups, and contribute to the development of safer, smarter, and more resilient national infrastructure systems.

TWI Leadership Visit to CNDE Strengthens Collaboration Opportunities in NDE

A delegation from TWI India Pvt Ltd, including Caroline Gumble, Harendra Kumar, B. A. Kumar, and R. J. Pardikar, visited the Centre for Non-Destructive Evaluation (CNDE) at IIT Madras on 19 February 2026. The visit marked an important step toward strengthening industry–academia collaboration in the field of Non-Destructive Evaluation (NDE).

During the visit, Krishnan Balasubramanian presented a comprehensive overview of CNDE's research activities, highlighting the centre's focus on translational research, industry-supported projects, and technology development aligned with real-world applications. The presentation also showcased successful startups and technology transfer initiatives that have emerged from CNDE, demonstrating the centre's commitment to innovation and commercialization.

The TWI delegation toured CNDE's advanced laboratory facilities and interacted with post-doctoral fellows and research scholars to gain a deeper understanding of ongoing research in areas such as advanced ultrasonics, structural health monitoring, AI-driven NDE, and next-generation inspection technologies. These interactions provided an opportunity to exchange ideas, identify common research interests, and explore potential joint research programs, training initiatives, and technology development projects.

The delegation also visited the IIT Madras Research Park, India's leading university-based research park, where they explored the innovation and incubation ecosystem. The visit included interactions with deep-tech startups such as XYMA Analytics, along with visits to various Centres of Excellence and industry research labs located within the Research Park. The delegation gained insight into how IIT Madras fosters collaboration between academia, industry, and startups to accelerate technology translation and deployment.

The visit concluded with discussions on potential collaboration areas, including joint research projects, industry training programs, student internships, collaborative technology development, and participation in international research initiatives. Both organizations expressed strong interest in building a long-term strategic partnership that would contribute to advancements in NDE technologies, workforce development, and global research collaboration.

This visit represents another significant step in CNDE's ongoing efforts to build strong global partnerships and expand its impact in research, innovation, and industry engagement in Non-Destructive Evaluation.

Invited Technical Talk at ISNT Industrial Forum O&G & Chemical

The Centre for Non-Destructive Evaluation at Indian Institute of Technology Madras is pleased to announce an upcoming invited technical talk organized by the Indian Society for Non-Destructive Testing under its Industrial Forum for Oil & Gas and Chemical sectors. Scheduled for 30 January 2026 (online), the talk titled "Interpretation of Radiographs" is part of the Back to Basics Series and will be delivered by Chittathur Srinivasan, Advisor at CNDE, IIT Madras.

The session will focus on the fundamental and practical aspects of radiographic interpretation, which are essential for ensuring accuracy and reliability in industrial radiographic testing. Key topics to be discussed include image quality evaluation, defect identification, artefact recognition, inspection geometry, exposure parameters, and applicable codes and standards used in radiographic inspection. Participants will gain insights into how radiographic images are analyzed to detect flaws such as cracks, porosity, inclusions, lack of fusion, and other discontinuities that may affect the integrity of critical engineering components.

Chittathur Srinivasan

ADVISOR AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

With over 35 years of experience spanning manufacturing, pressure vessels, heavy engineering equipment, and the hydrocarbon industry, Mr. Srinivasan brings a wealth of practical knowledge and field experience to the session. His extensive involvement in industrial inspections, code compliance, and quality assurance provides valuable perspectives on how theoretical principles of radiographic testing are applied in real-world industrial environments.

CNDE takes pride in hosting and supporting such knowledge-sharing initiatives that strengthen professional competencies in the field of non-destructive testing. Through collaborations with professional bodies like ISNT, the centre continues to promote technical excellence, skill development, and industry–academia engagement. Events like this reflect CNDE's commitment to advancing the science and practice of non-destructive evaluation while supporting the professional growth of engineers, researchers, and inspection specialists.

As one of the leading research centres dedicated to non-destructive evaluation, CNDE remains proud to contribute to the development of expertise in advanced inspection technologies and diagnostic methodologies. By facilitating interactions between experienced industry professionals and the broader technical community, the centre continues to foster a strong culture of learning, innovation, and professional excellence in the NDT domain.

Webinar on Non Destructive Evaluation Jointly Conducted by BIS and CNDE

The Centre for Non-Destructive Evaluation at the Indian Institute of Technology Madras was pleased to host a technical webinar delivered by Prof. Krishnan Balasubramanian, Institute Chair Professor in the Department of Mechanical Engineering, IIT Madras. The webinar, titled "In Search of the Invisible: Corrosion Detection for Process Industries," was organized by the Association for Materials Protection and Performance (AMPP) Chennai Chapter and focused on advanced approaches in non-destructive evaluation (NDE) and structural health monitoring (SHM) for early detection and characterization of corrosion in critical industrial infrastructure.

The session highlighted the growing challenges posed by corrosion in industries such as oil and gas, petrochemical processing, power generation, and chemical manufacturing, where undetected corrosion can lead to structural failures, safety risks, environmental damage, and significant economic losses. The webinar emphasized the importance of transitioning from conventional periodic inspection practices to continuous and predictive asset integrity management using modern monitoring technologies.

Prof . Krishnan Balasubramanian

HEAD AT THE CENTRE FOR NONDESTRUCTIVE EVALUATION

Prof.Balasubramanian presented insights into state-of-the-art inspection techniques, including guided-wave ultrasonics, long-range ultrasonic testing, drone-enabled inspections, and in-service monitoring solutions for pipelines, storage tanks, pressure vessels, and high-temperature systems. These techniques enable efficient detection of corrosion and material loss over large areas, including locations that are difficult to access using conventional inspection methods.

The webinar also discussed the integration of advanced sensing technologies with digital monitoring platforms, enabling data-driven maintenance and real-time infrastructure diagnostics. The role of structural health monitoring frameworks, sensor networks, and advanced signal processing techniques in improving corrosion detection reliability and sensitivity was also emphasized. In addition, emerging technologies such as autonomous inspection systems, robotics, and aerial inspection platforms were highlighted as transformative tools for improving inspection efficiency, reducing downtime, and enhancing safety in complex industrial environments.

The session provided valuable insights for researchers, industry professionals, and students by showcasing current advancements in corrosion detection technologies and their practical implementation in process industries. The webinar also reinforced the importance of industry–academia collaboration in advancing research and innovation in non-destructive evaluation and asset integrity management.

Peering Beneath the Surface: A Webinar on Non-Destructive Testing by CNDE IIT Madras & BIS

The Centre for Non-Destructive Evaluation (CNDE), IIT Madras, in association with the Bureau of Indian Standards (BIS), Metallurgical Engineering Department, successfully organized a webinar on "Non-Destructive Testing" on 16 March 2026. The webinar served as a platform for knowledge sharing and technical discussion, bringing together experts from academia, industry, and standards organizations to discuss the growing importance of Non-Destructive Testing in ensuring quality, reliability, and safety across engineering and manufacturing sectors.

The session covered the role of NDT in modern industries, various defect detection and inspection methodologies, and the importance of standards and certification in ensuring reliable inspection practices. The speakers also discussed emerging technologies, ongoing research developments, and the expanding career opportunities in the field of Non-Destructive Testing and Evaluation.

The webinar featured distinguished speakers including Shri B. Venkatraman, Former IGCAR and Chairman MTD-21; Shri Manoharan Venugopal, CEO, CNDE, IIT Madras; Prof. Krishnan Balasubramanian, Professor, IIT Madras; Shri Ashish V. Urewar, Scientist-D, BIS; and Shri Sanjiv Maini, Scientist-F and Senior

Director, BIS. The speakers shared their expertise on NDT techniques, standardization efforts, industry requirements, and future directions in inspection technologies and structural health monitoring.

The webinar provided valuable insights for students, researchers, and industry professionals by highlighting the importance of NDT in structural integrity assessment, quality assurance, and preventive maintenance. The interactive discussions also emphasized the need for stronger collaboration between academia, industry, and standards organizations to advance research, improve standards, and promote the effective implementation of NDT technologies.

CNDE continues to actively collaborate with national organizations such as BIS to promote research, standardization, training, and industry collaboration in Non-Destructive Evaluation and Testing, contributing to safer and more reliable engineering systems and infrastructure.

Honouring a Visionary: CNDE IIT Madras Hosts Special Lecture in Memory of Xerxes Desai

The Centre for Non-Destructive Evaluation (CNDE), Indian Institute of Technology Madras, organized a special guest lecture on 27th March 2026 at the HRDC, IIT Madras, in remembrance of the birth month of Mr. Xerxes Desai, Former Managing Director of Titan, whose visionary leadership and contributions to Indian industry continue to inspire generations of engineers, innovators, and leaders.

The lecture was conducted as part of CNDE's ongoing efforts to promote innovation, industry interaction, and knowledge sharing in the field of engineering and technology. The event brought together faculty members, researchers, students, and industry professionals for an engaging and insightful technical session.

The programme featured distinguished speakers including Prof. Krishnan Balasubramanian, Head of CNDE, IIT Madras, and Dr. Shankar Venugopal, Vice President – Technology Innovation at Mahindra & Mahindra. The speakers shared their insights on engineering innovation, technology development, and the importance of research–industry collaboration in driving technological excellence and societal impact.

The lecture served as a meaningful platform for participants to gain insights from leaders in academia and industry, while also commemorating the legacy of Mr. Xerxes Desai, whose contributions to corporate leadership and innovation continue to motivate the engineering community.

CNDE expresses its sincere gratitude to the speakers and participants for making the event informative and memorable, and looks forward to organizing more such knowledge-sharing events in the future.

CNDE Demonstrates Cutting-Edge NDE Technologies at IIT Madras

The Centre for Non-Destructive Evaluation (CNDE) at Indian Institute of Technology Madras actively participated in the recent Open House event, welcoming a large and diverse group of visitors to its laboratory facilities. The event served as an excellent platform for the centre to showcase its ongoing research initiatives, advanced instrumentation, and technological innovations in the field of non-destructive evaluation (NDE). Students, researchers, industry professionals, and members of the public had the opportunity to closely observe how modern NDE techniques are used to assess material integrity, detect hidden defects, and ensure the safety and reliability of engineering structures without causing damage to the components being inspected.

During the demonstrations, visitors were introduced to several cutting-edge inspection technologies including ultrasonic testing, radiographic imaging, acoustic emission monitoring, and advanced signal processing methods used for defect detection and structural health monitoring. Researchers at CNDE explained how these techniques are applied in critical sectors such as aerospace, nuclear power, oil and gas, manufacturing, and infrastructure. The demonstrations highlighted how non-destructive evaluation plays a vital role in preventive maintenance, quality assurance, and life-cycle assessment of engineering systems. Visitors showed keen interest in understanding how advanced imaging and sensing technologies can help identify internal flaws in materials, monitor degradation over time, and improve safety standards in industrial environments.

The Open House also provided an opportunity for CNDE researchers to present their ongoing projects and collaborative initiatives with national laboratories, research institutions, and industry partners. Faculty members and graduate students interacted with visitors by explaining experimental setups, simulation tools, and data analysis techniques used in their research. These interactions created a valuable platform for knowledge exchange and helped demonstrate how academic research can translate into practical solutions for real-world engineering challenges.

The enthusiastic participation and positive response from visitors underscored the growing importance of advanced diagnostic and monitoring technologies in modern industries. CNDE extends its sincere appreciation to all the students, faculty members, industry professionals, and members of the public who visited the laboratory and engaged in insightful discussions with the research team. Such outreach activities play a crucial role in strengthening public awareness of scientific research, fostering collaborations between academia and industry, and inspiring the next generation of engineers and scientists to contribute to cutting-edge technological advancements.

"Engaging with students, industry professionals, and the wider community helps bridge the gap between research and real-world applications, inspiring the next generation of engineers and researchers."

AI in NDE: Transforming Inspection Through CNDE's Training Initiative

The Centre for Non-Destructive Evaluation at Indian Institute of Technology Madras, in association with the National Consortium for Non-Destructive Evaluation and Dhvani Analytic Intelligence, successfully conducted a two-day hands-on training program titled "AI in NDE: Assisted Inspection Tools for RT & PAUT."

The program brought together industry professionals, researchers, and students for an intensive learning experience focused on the practical deployment of artificial intelligence in Radiographic Testing (RT) and Phased Array Ultrasonic Testing (PAUT). Participants were introduced to AI-assisted inspection tools, real-world industrial case studies, and emerging technological developments that are shaping the future of non-destructive evaluation.

The training program emphasized the growing convergence of artificial intelligence, advanced sensing, and digital inspection technologies in modern industrial environments. Through a series of technical lectures, demonstrations, and interactive sessions, participants gained insights into how AI algorithms can support inspectors in identifying defects, interpreting complex signals, and improving the reliability of inspection outcomes. The sessions also highlighted how machine learning models can be trained using large inspection datasets to recognize patterns in radiographic images and ultrasonic signals that may otherwise be difficult to detect through conventional analysis.

A key feature of the program was its hands-on learning approach, allowing participants to interact directly with AI-enabled inspection tools and software platforms. These sessions provided practical exposure to workflows involving data acquisition, automated defect detection, signal interpretation, and AI-assisted decision support systems. Such practical demonstrations helped participants understand how AI technologies can complement the expertise of inspectors rather than replace it, enabling more efficient and consistent inspection processes.

The training also provided an opportunity for meaningful discussions on the challenges and opportunities associated with adopting AI in industrial NDE applications, including issues related to data quality, model validation, standardization, and integration with existing inspection protocols. Experts from academia and industry shared their perspectives on how these challenges can be addressed through collaborative research, shared datasets, and the development of robust validation frameworks.

The event served as an important platform for knowledge exchange and professional networking, fostering dialogue between academic researchers, technology developers, inspection service providers, and industrial asset owners. Such interactions are essential for accelerating the translation of research innovations into deployable industrial solutions.

For the CNDE community, the program reflects the center's continued efforts to promote next-generation NDE technologies and build technical capacity within the inspection ecosystem. By organizing training programs that integrate AI, digital technologies, and advanced sensing techniques, CNDE aims to equip professionals with the skills required to address the evolving challenges of infrastructure monitoring, manufacturing quality assurance, and asset integrity management.

CNDE extends its sincere appreciation to all speakers, collaborators, technical experts, and participants whose contributions made the program a resounding success. Through initiatives like this, the centre continues to strengthen its role as a hub for innovation, education, and industry collaboration in non-destructive evaluation and structural health monitoring.

The program also reaffirms CNDE's commitment to advancing the vision of NDE 4.0, where intelligent inspection systems, data-driven analytics, and human expertise work together to enable safer, smarter, and more reliable industrial operations.


NDE 2.0:
Early Digital
NDE 3.0:
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In-House Training Program on Digital Radiography Conducted for HMEL

The Centre for Non-Destructive Evaluation (CNDE), Indian Institute of Technology Madras, successfully conducted an in-house training program on Digital Radiography for the Inspection Group of HPCL-Mittal Energy Limited (HMEL) at the HMEL Training Centre, Bathinda. The program was designed to provide both theoretical knowledge and practical exposure to modern digital radiographic inspection techniques used in industrial applications.

A total of 21 inspection engineers from HMEL participated in the training program. The sessions covered fundamental principles as well as practical aspects of digital radiography, with a focus on Digital Detector Arrays (DDA), Computed Radiography (CR), image quality parameters, and relevant ASTM, ASME, and ISO standards. The training also included modules on welding inspection, interpretation and evaluation of digital radiographs, and the application of image processing tools for radiographic analysis and defect characterization.

The program was delivered by Mr. C. Srinivasan and Mr. Manoharan Venugopal from CNDE, IIT Madras, who shared their expertise and practical insights on digital radiographic inspection and industry practices. A specialized session on Digital Radiography using flexible detectors and Corrosion Under Insulation (CUI) inspection was conducted by Mr. Samaresh Changdar from Waygate Technologies, providing participants with exposure to advanced inspection solutions used in challenging industrial environments. In addition, Prof. Abhishek Saini from CNDE delivered a session on the emerging role of Artificial Intelligence in Non-Destructive Evaluation, highlighting how AI and data-driven techniques are transforming inspection, defect detection, and structural health monitoring.

The training program provided a valuable platform for knowledge sharing, technical discussions, and hands-on learning, helping participants enhance their understanding of digital radiographic inspection and its practical implementation in industrial inspection and asset integrity management.

CNDE sincerely appreciates the support and coordination provided by Mr. Anshuman Agarwal, Mr. Kishalya Kishore, and Mr. Ayon Bhattacharya from HMEL, whose efforts helped ensure the smooth and successful conduct of the training program.

CNDE Startup Rail Labs Earns Spot at National AI Impact Summit 2026

Rail Labs, a startup incubated at the IITM Incubation Cell of Indian Institute of Technology Madras and associated with Bharat Innovates 2026, has been selected to participate in the AI Impact Summit 2026 organized under the Ministry of Education. The summit will take place at Bharat Mandapam in New Delhi.

Founded by Krishnan Balasubramanian, Mr. Rajesh Rathi, and Mr. Sumit Anand, Rail Labs is focused on advancing RailTech through AI-enabled smart inspection systems and predictive safety solutions for railway infrastructure. The startup is developing technologies aimed at improving the inspection, monitoring, and predictive maintenance of railway assets, including tracks, rolling stock, and associated infrastructure systems. By integrating artificial intelligence with advanced sensing and non-destructive evaluation methods, Rail Labs seeks to enable faster defect detection, improved reliability, and data-driven safety management for modern railway networks.

The startup's selection underscores its contributions to developing next-generation technologies that enhance operational reliability and infrastructure safety in rail operations. Out of more than 500 applicant startups, only three were chosen for this prestigious national platform, making the recognition a significant milestone in the startup's journey. Participation in the summit will provide Rail Labs an opportunity to showcase its innovations to policy makers, industry leaders, investors, and technology experts, opening pathways for collaboration, pilot deployments, and large-scale implementation.

The achievement also highlights the strength of deep-tech innovation emerging from the IIT Madras ecosystem, where interdisciplinary research and entrepreneurship are actively encouraged. With strong support from the institute's incubation and research environment, startups like Rail Labs are translating cutting-edge research into deployable technologies that address critical national infrastructure challenges.

For the Centre for Non-Destructive Evaluation community, this recognition represents a proud moment, reflecting the center's growing impact in fostering technology-driven startups working at the intersection of artificial intelligence, sensing technologies, and infrastructure monitoring. CNDE has been actively supporting innovations that combine advanced non-destructive evaluation methods with intelligent data analytics, enabling new solutions for asset integrity management in sectors such as transportation, energy, and manufacturing.

The participation of Rail Labs in the AI Impact Summit 2026 also demonstrates the increasing relevance of AI-enabled inspection and monitoring technologies in large-scale infrastructure systems. As railway networks expand and become more technologically complex, intelligent inspection platforms will play a vital role in ensuring safety, efficiency, and long-term sustainability.

CNDE congratulates the Rail Labs team on this remarkable achievement and looks forward to seeing the startup represent the IIT Madras innovation ecosystem on a national stage. Such milestones reinforce CNDE's commitment to nurturing research-driven entrepreneurship, supporting technology commercialization, and contributing to the development of smarter and safer infrastructure for the nation.

Ashwin AI Named Top 30 Finalist at AI by HER Challenge

Plenome Technologies has announced that Ashwin AI, its flagship AI-powered clinical documentation solution, has been selected as a Top 30 Finalist at the prestigious AI by HER Challenge. Chosen from over 800 applications representing more than 50 countries, this recognition highlights the platform's growing global impact and its commitment to delivering responsible, scalable artificial intelligence solutions for healthcare systems.

Ashwin AI will also be showcased at the India AI Impact Summit 2026, where global innovators, policymakers, healthcare leaders, and technology experts will convene to explore the future of artificial intelligence and its transformative role across sectors. The summit provides a valuable platform for emerging technologies to demonstrate real-world impact and engage with stakeholders shaping the next generation of AI-enabled solutions.

Designed to address one of the most pressing challenges in modern healthcare—clinical documentation and workflow efficiency Ashwin AI leverages advanced natural language processing and AI-assisted transcription technologies to support clinicians in generating accurate medical documentation. By reducing the administrative burden on healthcare professionals, the platform enables physicians to spend more time focusing on patient care, diagnosis, and clinical decision-making.

The recognition of Ashwin AI at an international platform such as the AI by HER Challenge reflects the growing importance of responsible AI development, particularly in sectors where accuracy, transparency, and reliability are critical. The solution has been designed with a strong emphasis on ethical AI deployment, data privacy, and scalability, ensuring that healthcare providers can confidently integrate AI-assisted tools into their clinical workflows.

From a broader innovation perspective, achievements such as this demonstrate how AI-driven technologies developed within the Indian deep-tech ecosystem are gaining global recognition. The success of Ashwin AI highlights the potential of interdisciplinary collaboration between healthcare professionals, engineers, and data scientists in creating solutions that address complex real-world challenges.

For the Centre for Non-Destructive Evaluation community at Indian Institute of Technology Madras, this recognition represents another example of how AI and advanced data analytics are transforming traditional domains and creating new opportunities for innovation. While CNDE's core focus lies in non-destructive evaluation, sensing technologies, and structural health monitoring, the increasing adoption of AI across sectors from healthcare to infrastructure underscores the importance of data-driven intelligent systems in solving complex engineering and societal challenges.

CNDE congratulates the Plenome team on this outstanding achievement and looks forward to continued advancements that demonstrate how responsible artificial intelligence can create meaningful impact across industries and global communities.

CNDE Scholar Going Global: Research and Thought Leadership in NDE 4.0

The field of Non-Destructive Evaluation is currently undergoing a major transformation driven by digital technologies, artificial intelligence, and Industry 4.0 integration. The emerging concept of NDE 4.0 aims to digitally connect inspection data, engineers, and industrial systems to support smarter decision-making and lifecycle asset management.

Against this backdrop, Srijan Tiwari, an active researcher from the Centre for Non-Destructive Evaluation (CNDE), IIT Madras, working in the domain of NDE 4.0 and AI-enabled inspection ecosystems, has recently contributed to global conversations on the future of the NDE workforce and digital inspection systems.

His article titled "The Future of NDT Workforce: Skills, Certification, and Digital Readiness" was featured in NDT SCOOP Magazine (Q1 2026), highlighting how the next generation of inspection professionals must combine traditional NDT expertise with digital fluency, data literacy, and emerging technologies. The discussion addresses a key challenge facing the industry today—the growing gap between workforce capabilities and the rapid pace of technological change in

In addition, Srijan's work on digital NDE ecosystems and workforce readiness has also been featured in the American Society for Nondestructive Testing (ASNT) publication covering the Middle East and Africa region:

"Digital NDE Ecosystem 2030: Skills, Trust, and Technology."

The article discusses how future inspection ecosystems will depend on three critical pillars:

- Skilled and digitally prepared professionals
- Trustworthy AI-enabled inspection systems
- Integrated technology platforms connecting training, inspection, and data.

Beyond thought leadership articles, Srijan has also contributed to research on AI-augmented knowledge systems for NDE, exploring how technologies such as Retrieval-Augmented Generation (RAG) can support engineers in accessing technical knowledge from standards, manuals, and inspection procedures.

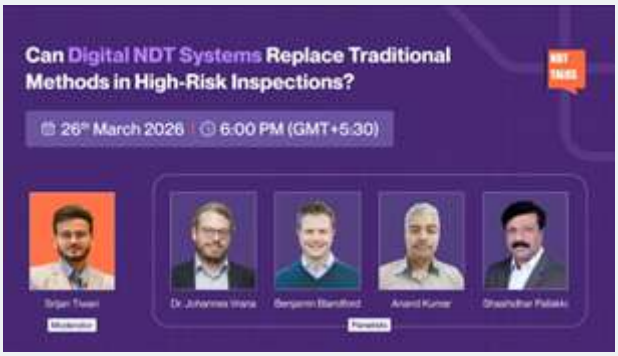
These contributions reflect the growing role of CNDE researchers in shaping global conversations on the future of inspection technologies, workforce development, and the digital transformation of NDE.

As the discipline continues to evolve toward data-driven inspection ecosystems, the integration of research, industry collaboration, and emerging digital technologies will be critical in defining the next generation of NDE practices worldwide.

CNDE Scholar Going Global: Research and Thought Leadership in NDE 4.0

Srijan Tiwari, entrepreneurial research scholar at CNDE, IIT Madras, and Co-founder & CEO of TIQWorld Pvt. Ltd., moderated the second edition of NDT Talks hosted by OnestopNDT on 26th March 2026. The session brought together a distinguished international panel to examine one of the more pressing questions in the inspection community today: whether digital NDT systems are ready to replace traditional methods in high-risk, safety-critical environments.

The panel comprised Dr. Johannes Vrana, a consultant at the forefront of digital transformation and IIoT in NDE; Dr. Benjamin Blandford, a technical expert in NDE research and product development; Mr. Anand Kumar, Lead Engineer at Nayara Energy with prior leadership at Reliance Industries; and Mr. Shashidhar P. Pallakki, CEO of Pallakki NDT Excellence Center. The conversation spanned the current maturity of digital inspection systems, the trust and validation frameworks needed for critical adoption, the evolving role of human expertise alongside automation, and the long-term outlook for a hybrid or fully digital inspection paradigm.



At TIQWorld, Srijan and his team have been developing a framework that treats Manufacturing Quality as a function of three interdependent pillars: People, Process, and Systems. This perspective holds that digital transformation in inspection cannot be reduced to a technology adoption question alone. It is equally about the competency of the professionals operating within these systems, the integrity of the processes governing inspection decisions, and the platforms that bring these elements into a coherent, auditable workflow. The NDT Talks discussion landed squarely within this thinking, as panelists navigated questions of trust, validation, human expertise, and real-world adoption with exactly this kind of layered lens.

Srijan's role as a moderator in forums such as this reflects a deliberate approach to industry thought leadership, one that complements the research work being pursued at our lab.

CNDE Startup Representative at Republic Day Celebrations – Raj Bhavan, Chennai

Mr. Srijan Tiwari, represented TIQWorld Pvt. Ltd., an incubated startup of the IIT Madras Incubation Cell, had the honour of attending the Republic Day Celebrations at Raj Bhavan, Chennai, in the presence of Hon'ble Governor Ravindra Narayana Ravi and the First Lady Tmt. Laxmi Ravi. Srijan was among a select group of startup representatives from Tamil Nadu invited to this prestigious occasion.

This recognition highlights the growing impact of startups emerging from the Indian Institute of Technology Madras innovation ecosystem, particularly those associated with the Centre for Non-Destructive Evaluation and the broader IIT Madras Research Park and incubation ecosystem.

The participation of TIQWorld in this national occasion reflects the strength of the industry academia startup ecosystem nurtured at IIT Madras, where research, innovation, and entrepreneurship come together to create technologies with national relevance and global impact. It also represents the growing contribution of deep-tech startups working in areas related to quality, diagnostics, and advanced engineering technologies aligned with national missions and future industrial needs.

CNDE congratulates Srijan and the TIQWorld team on this recognition and takes pride in seeing startups from the IIT Madras ecosystem representing Tamil Nadu at such prestigious national platforms. Such milestones continue to inspire students, researchers, and entrepreneurs within the CNDE community to translate research into real-world impact and contribute to India's innovation and technology leadership.

Seminars

MS Research Seminar on AI-Enabled Digital Infrastructure for Manufacturing Quality

Mr. Srijan Tiwari, M.S. (Entrepreneurship) Research Scholar at the Centre for Non-Destructive Evaluation (CNDE), Department of Mechanical Engineering, IIT Madras, recently delivered his M.S. seminar titled *"From Fragmentation to Systemic Integration: An AI-Enabled Digital Infrastructure Layer for Manufacturing Quality Ecosystems."*

The seminar explored the structural challenges within the manufacturing quality ecosystem—particularly across training, recruitment, procurement of inspection equipment, and quality reporting workflows. These functions currently operate in fragmented silos, leading to inefficiencies such as delayed procurement, skill-matching challenges in recruitment, and manual documentation practices in inspection processes.

During the presentation, Mr. Tiwari introduced TIQ_World, a digital platform designed to connect the three core pillars of manufacturing quality: People, Skills, and Systems. The platform integrates modules for training and certification, talent recruitment, procurement of inspection tools, and AI-assisted inspection reporting, with the objective of improving traceability, operational efficiency, and quality compliance across manufacturing industries.

The research is being conducted under the supervision of Prof. Krishnan Balasubramanian, CNDE, IIT Madras. It reflects the broader vision of the M.S. Entrepreneurship program at IIT Madras, which focuses on translating research insights into scalable industry solutions and fostering innovation at the intersection of engineering, digital technologies, and entrepreneurship.

The seminar was attended by faculty members, research scholars, and students of the department, followed by an engaging discussion on the future of AI-enabled platforms for manufacturing quality and inspection ecosystems.

Enhancing Railway Track Integrity through the Strategic Deployment of Autonomous Inspection Systems

Seminar Overview

Kaushik V N delivered a powerful MS Entrepreneurship seminar exploring how autonomous robotic inspection systems can revolutionise railway safety in India and beyond. Drawing on CNDE's deep NDE research expertise, the seminar combined real-world customer insights with lean startup principles, presenting a complete roadmap from problem discovery to global market entry.

5 Key Themes Explored

Customer Discovery

Through structured field interviews with Indian Railways, freight operators, and private metro networks, uncovered the core pain points: infrequent manual track inspections, rising derailment risks, and exploding maintenance costs. The research validated that over 60% of rail incidents stem from undetected track geometry and material faults defining a clear, urgent problem worth solving.

Product-Market Fit

The proposed solution an autonomous inspection robot with multi-modal NDE sensors (Ultrasonic, Laser profiler, and Vision Inspection) for predictive maintenance across Indian Railways and global rail networks. Real-time defect classification and automated reporting address the exact workflow gaps identified during customer discovery.

Technology Feasibility

Leveraging sensor fusion research, which outlined a credible TRL 4-to-6 roadmap. The prototype integrates multi-modal NDE sensors onto a autonomous rail-riding chassis. Edge AI models trained on defect datasets enable on-device classification without connectivity dependency, demonstrating strong technical readiness.

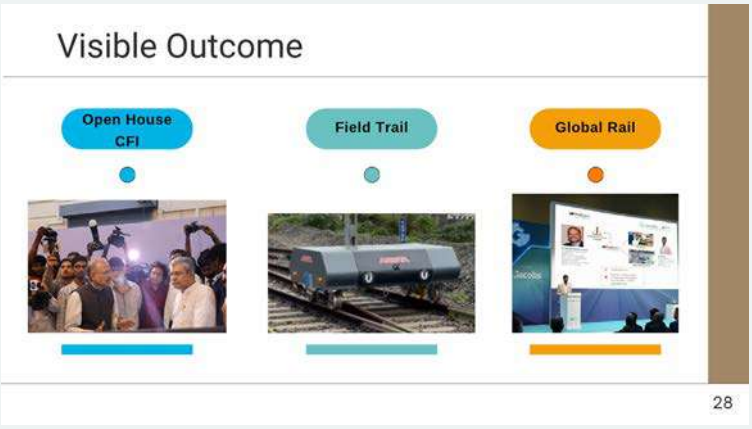
Business Model

A hybrid revenue architecture was proposed: The inspection robot fleet paired with a monthly SaaS subscription for the AI analytics cloud platform. A pilot-first GTM strategy targets Southern Railway zones and private metro operators, with annual inspection contracts providing stable recurring revenue.

Scaling the Business

The scaling roadmap spans three horizons: domestic pilots across 3 railway zones (Year 1-2), pan-India expansion and Tier-1 freight corridor partnerships (Year 3-4), and international European and Southeast Asian rail operators (Year 5+). Key growth levers include FRA/RDSO certification, OEM partnerships with rail equipment manufacturers, and a SaaS fleet dashboard for 100+ deployed units.

Visible Outcomes Achieved



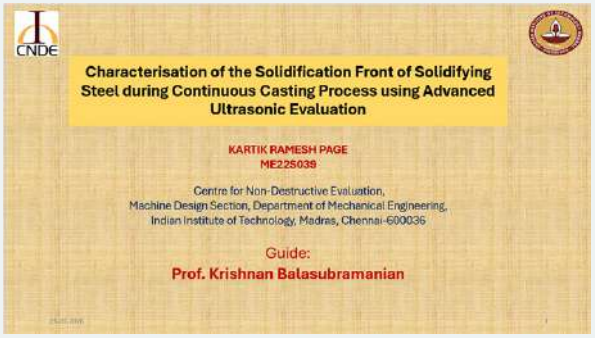
Scaling the Business

- Successfully completed GDC incubate program a Boot camp for early-stage start-up teams, to search for the elusive problem-solution fit.
- Presented the solution in ICNDE and got feedback and insights from industry experts.
- Open House at CFI public demo of the prototype robot to various stakeholders.
- Exhibited the prototype at NDE 24
- Field Trial - successful autonomous run on live railway track with real-time defect logging.
- Invited Speaker at Global Rail Conference presented insights on revolutionising operational safety with cutting-edge digital solutions for the modern railway industry, for gaining industry traction.

Characterisation of the Solidification Front of Solidifying Steel during Continuous Casting Process using Advanced Ultrasonic Evaluation

Seminar Overview

Kartik Ramesh Page delivered an engaging seminar on improving ultrasonic inspection in high-temperature manufacturing environments. Focusing on phased-array ultrasonic techniques, he discussed how temperature gradients during the solidification of steel can affect defect detection and imaging accuracy. The seminar highlighted practical solutions, including velocity-compensation strategies and high-temperature probe protection, offering a pathway to more reliable inspections in processes such as continuous steel casting.



5 Key Themes Explored

Phased Array Ultrasonic

Advanced phased-array ultrasonic techniques were explored, using Full Matrix Capture and Total Focusing Method to enhance defect imaging and evaluation.

Modelling of the Solidus Region of Steel

A finite element model representing the solidus region of solidifying steel was developed to study temperature-dependent material behaviour.

Simulation Study of Temperature Gradient Effects

The impact of through-thickness temperature variations on ultrasonic defect detection and imaging accuracy was investigated through simulations.

Velocity Compensation Algorithm

A layer-wise algorithm was implemented to correct for spatial changes in ultrasonic velocity, improving the accuracy of reconstructed images.

Sensor Protection and Active

Wedge materials and cooling strategies were evaluated to safeguard the phased-array probes during inspections of hot surfaces.

Visible Outcomes & Milestones

International Conferences and Papers:

1. EWSHM 2024 (11th European Workshop on Structural Health Monitoring) 10-13 June 2024, Potsdam, Germany Presented the research work titled “Phased Array Ultrasonic Imaging for Characterising Steel with an Elevated Temperature Gradient.” Published a conference paper in NDT.net
2. 2024 6th International Conference on Advances in Materials, Mechanical and Manufacturing (AMMM 2024), Tokyo, Japan, September 6-8, 2024 Presented the research work titled “Finite Element Analysis for Characterisation of Steel Material Properties using Bulk Ultrasonic Waves.”

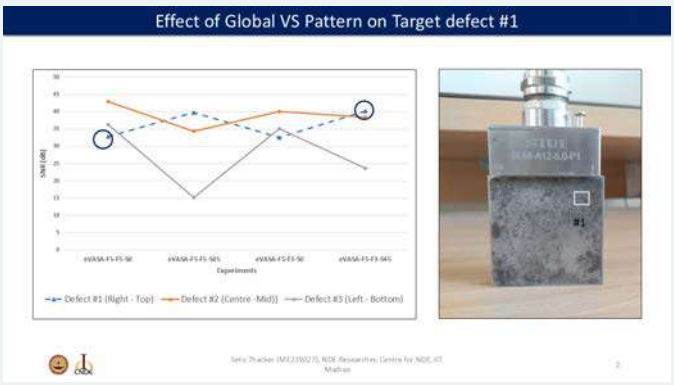
National Conferences:

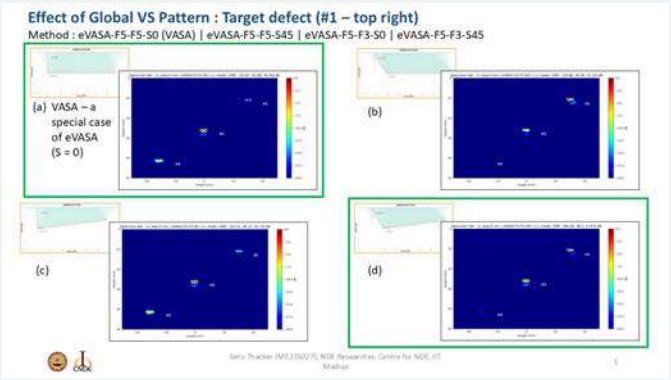
1. 33rd Annual Conference & Exhibition on Non-Destructive Evaluation (NDE 2023), December 7-9, 2023, Pune, India Presented the research work titled “Advanced Ultrasonic Non-destructive Testing for High Temperature Characterisation.”
2. 34th Annual Conference & Exhibition on Non-Destructive Evaluation (NDE 2024), December 12-14, 2024, Chennai, India Presented the research work titled “In-situ Phased Array Ultrasonic Evaluation for characterising Solid-Liquid Interface during Continuous Casting of Steel.”
3. 3rd International Conference & Exhibition on NDE 4.0, 3-6 March 2025, Taj Yeshwantpur, Bengaluru
4. 35th Annual Conference & Exhibition on Non-Destructive Evaluation (NDE 2025), December 11-13, 2025, Mumbai, India Presented the research work titled “Characterisation of the Solidification Front of Solidifying Steel during Continuous Casting Process using Phased Array Ultrasonic Testing.”

Paradigm shift in PAUT: Redefining the Ultrasound Imaging Using Custom Phased Array Excitation

The conventional Phased Array Ultrasound Testing (PAUT) technique employs a series of piezoelectric transducers to facilitate beamforming and enhance imaging capabilities. A more recent methodology, which incorporates Full Matrix Capture/Total Focusing Method (FMC/TFM), further advances this technique through synthetic focusing for image reconstruction. In this research, we present a novel hybrid approach known as eVASA, which integrates active focusing and steering by leveraging the concept of a virtual source within the material during PAUT. eVASA stands for eccentric Virtual Aperture Source Array, offers key advantages, including (a) the capability to transmit waves at a specified angle while simultaneously focusing at a designated depth from the contact surface, (b) a reduction in inspection time, (c) the ability to perform inspections without the use of a wedge to provide beam directivity up to a certain angle, and (d) an improved signal-to-noise ratio (SNR) in the imaging of defects located far from the leading edge of the transducer.

The eVASA technique employs a customized excitation or firing sequence, in which elements within the active aperture transmit ultrasonic waves according to pre-calculated delay laws. This procedure achieves beamforming directed towards virtual sources positioned beneath the transducer at user-defined depths and angles. The excited waves constructively interfere at the virtual source and subsequently propagate toward the region of interest (RoI). As a result, a highly energized wavefront travels through the material in a specific direction after converging at a virtual source location. Once required excitations have been executed to cover the intended inspection area within the material, synthetic focusing algorithms, known as Total Focusing Method (TFM), can be applied to reconstruct the 2D image. Parameters such as the depth and angle of the virtual sources, as well as the number of elements in the active aperture of the probe, are defined by the user. A comparative analysis of eVASA and FMC demonstrates a substantial improvement in SNR, even when the transducer is positioned at a considerable distance from RoI. Moreover, eVASA can be implemented using standard PAUT probes and instruments. The primary challenge lies in determining the optimal locations of the virtual sources within the material to achieve an enhanced signal-to-noise ratio. This study aims to demonstrate the beamforming capability achieved through the utilization of virtual sources.





Presenter : Thacker Setu Rameshbhai
Guide : Prof. Krishnan Balasubramanian

Recent Publications

Characterisation of the Solidification Front of Solidifying Steel during Continuous Casting Process using Advanced Ultrasonic Evaluation

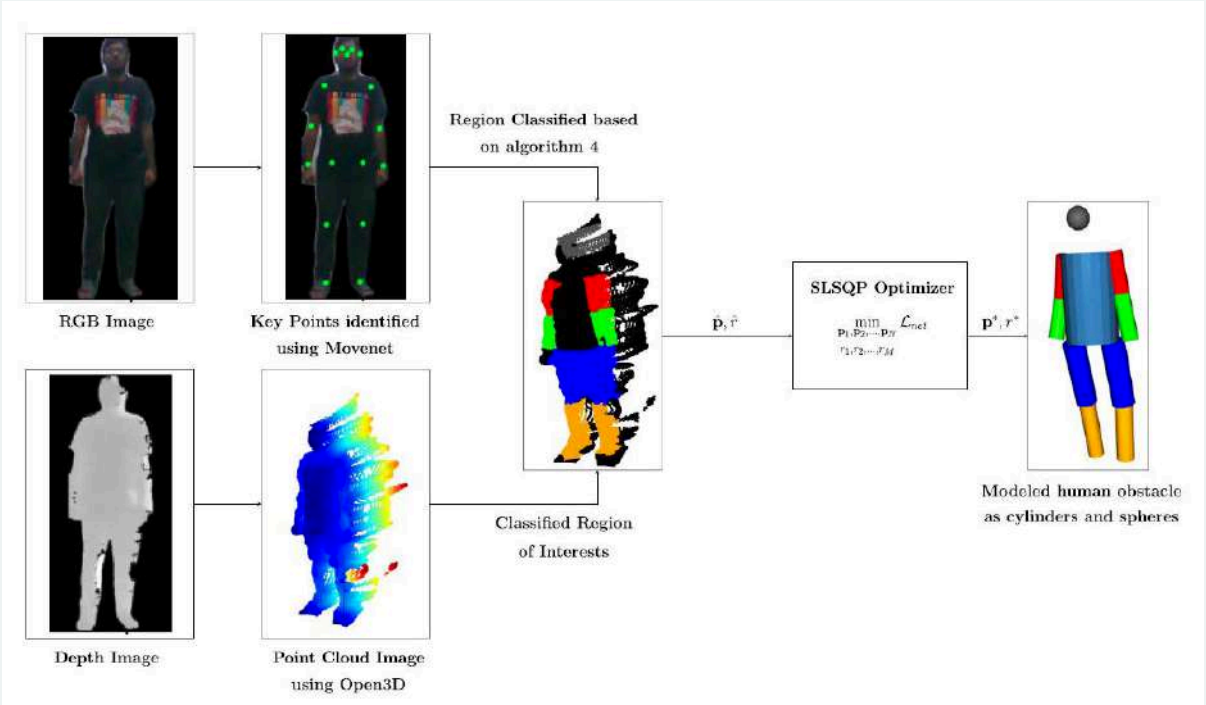
A recent study presents a significant advancement in motion planning for robots operating in human-populated environments, particularly in confined spaces such as retail settings. The research focuses on improving both safety and efficiency in robotic systems, especially for serial manipulators, which are widely used across industries including automotive, pharmaceutical, retail, and research.

The work, carried out by Sai Teja Narendula, Akhil Bandamidapalli, and Gokula Vishnu Kirti Damodaran under the guidance of Professor Prabhu Rajagopal, introduces a hybrid motion-planning framework that combines a Modified Artificial Potential Field (APF) method with Probabilistic Roadmaps (PRM). This integrated approach addresses key challenges of traditional algorithms, such as local minima issues in APF and inefficiencies in standalone sampling-based planners.

A standout feature of the study is its human-aware modeling approach. By leveraging computer vision techniques, the system uses RGB and depth data to represent humans as simplified geometric shapes such as cylinders and spheres. This enables accurate and computationally efficient detection and avoidance of human obstacles, allowing robots to navigate dynamically and safely in real-world environments.

The proposed method is evaluated against widely used planning algorithms, including PRM and Rapidly Exploring Random Trees (RRT), in scenarios involving a six-degree-of-freedom serial manipulator mounted on a flat surface. Performance is assessed using critical metrics such as path length, joint angle variation, and computation time. Results demonstrate that the hybrid APF-PRM approach consistently produces shorter, smoother, and more stable paths, while significantly reducing erratic robot motion and improving overall safety.

This research highlights a promising direction for the development of human-aware robotic systems, with practical applications in retail automation, assistive robotics, and collaborative industrial environments. The study also opens avenues for further refinement of motion-planning algorithms to enhance real-time adaptability and robustness.



Flow chart depicting the sequence of steps involved in determining the key points and the radius of the modeled human obstacle using computer vision and the SLSQP optimizer

AI-Augmented Knowledge Systems for NDE 4.0

Artificial Intelligence is increasingly being discussed as a transformative force across industries. However, in specialized engineering domains such as Non-Destructive Evaluation (NDE), the more relevant question is not simply what AI can do, but where it can create meaningful value.

Over the past several months, this question has emerged frequently in discussions within the NDE community among researchers, practitioners, and industry professionals. A recurring challenge is the fragmentation of technical knowledge across standards, inspection manuals, research literature, and field procedures. Accessing the right information at the right time often requires significant experience or mentorship.

Motivated by this observation, Srijan Tiwari, an active researcher from the Centre for Non-Destructive Evaluation (CNDE), IIT Madras, working in the domain of NDE 4.0, explored how Artificial Intelligence can assist engineers in navigating complex technical knowledge systems.

This work resulted in the research study titled:

"Bridging the Knowledge Gap in NDE 4.0: AI-Augmented Insights through Retrieval-Augmented Generation (RAG)"

The study investigates the application of Retrieval-Augmented Generation (RAG) frameworks to NDE knowledge systems. Unlike conventional generative AI approaches, RAG integrates domain-specific resources such as standards, manuals, and technical documentation into a retrieval pipeline before generating responses. This enables AI systems to provide contextually grounded insights while maintaining alignment with established engineering knowledge.

The objective is not to replace engineering expertise, but to augment decision-making by enabling faster access to structured domain knowledge, particularly in complex inspection environments.

The research was conducted under the guidance of Prof. Krishnan Balasubramaniam and was presented at the International Workshop on Structural Health Monitoring (IWSHM), Stanford University.

As the field moves toward NDE 4.0 and digital inspection ecosystems, such AI-enabled knowledge systems may play an important role in improving knowledge accessibility, supporting engineers in the field, and strengthening the integration of digital technologies with established NDE practices.

Monte Carlo Simulation for Radiation–Matter Interaction at the 191st CNDE Research Group Meeting

Presenter: Dr. Divya Pandya, Post-Doc researcher, CNDE, IITM

Core Objective and Methodology:
The presentation details the use of Monte Carlo (MC) simulations to model and interpret the complex, probabilistic nature of radiation interacting with matter. Because analytical solutions for multiple scattering are often unfeasible,

Physics Foundation and Backscatter Imaging:
A significant portion of the talk focuses on Compton Backscattering (CBS) and its application in imaging. You explained that image contrast in backscatter imaging is primarily determined by electron density, as the probability of Compton scattering is directly proportional to it. The theoretical framework presented includes:

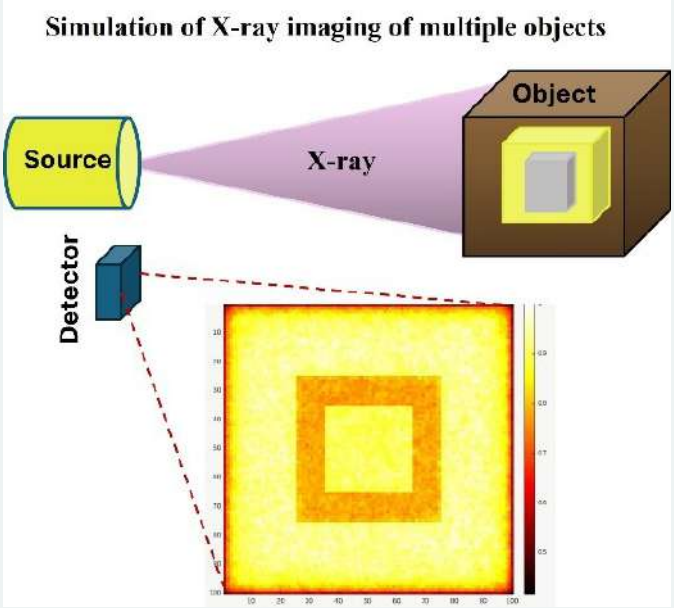
- The Klein-Nishina Formula: Used to determine the differential cross-section and angular distribution of scattered radiation.
- Attenuation Laws: Governing photon survival and the resulting signal intensity received by detectors.
- Key Variables: Insights showing that backscatter signals depend on photon survival, detector geometry, and material contrast.

Simulation Tools: Geant4 vs. FLUKA:
You provided a comparative analysis of leading industry tools, specifically contrasting Geant4 and FLUKA:

- Geant4: Described as a highly flexible, C++ based open-source toolkit that requires the user to manually define geometry, physics lists, and detector responses.
- FLUKA: Highlighted for its "ready-to-use" validated physics models and simpler, input-file-based setup with GUI support (FLAIR), making it efficient for standard problems like shielding and X-ray interactions.

Practical Application and Challenges:
The presentation concludes with a practical case study: an LMR (Lateral Migrated Radiography) configuration simulating soil buried with plastic and metal using FLUKA. While simulations provide detailed results, you noted several critical challenges:

- Computation Time: Achieving 2D imaging with low statistical noise (error ~2%) can require over 24 hours of processing.
- Complexity: Accurately modeling realistic detector responses and managing artifacts created by higher-order multiple scattering



CNDE Secures ₹3.4 Crore Grant Under National Quantum Mission

The National Quantum Mission, led by the Department of Science and Technology (DST), aims to position India as a global leader in quantum technologies. As part of this prestigious initiative, the Centre for Non-Destructive Evaluation (CNDE), IIT Madras, has been awarded a grant of ₹3.4 Crore for a project focused on developing quantum algorithms and architectures for next-generation diagnostics and beyond-scale analytics.

This project will be undertaken as a collaborative effort between IIT Madras, IIT Hyderabad, and IISc Bangalore, bringing together interdisciplinary expertise from physics, mathematics, mechanical, aerospace, and civil engineering.

CNDE extends its sincere gratitude to all those who contributed to conceptualizing and developing this proposal:

- Prof. Prabhu Rajagopal - Project Lead and Principal Investigator, Mechanical Engineering, IIT Madras
- Prof. Neelesh Shankar Upadhye - Mathematics, IIT Madras
- Prof. Vaibhav Madhok - Physics, IIT Madras
- Dr. Tarun Naskar - Civil Engineering, IIT Madras
- Dr. Keshav Bharadwaj Ravi - Civil Engineering, IISc Bangalore
- Prof. J. M. Chandra Kishen - Civil Engineering, IISc Bangalore
- Prof. Debraj Ghosh - Civil Engineering, IISc Bangalore
- Dr. Thulsiram Gantala - Mechanical & Aerospace Engineering, IIT Hyderabad
- Amrita - PhD Research Scholar, IIT Madras (under the guidance of Prof. Prabhu Rajagopal and Prof. Krishna Jagannathan, Electrical Engineering, IIT Madras)

This initiative presents an exciting opportunity to explore quantum-enabled approaches for advanced data analysis and insight generation from large-scale datasets (big data), with the potential to create a transformative impact on next-generation diagnostics and Non-Destructive Evaluation (NDE) technologies.

We also gratefully acknowledge the support of our industry partners IGCAR, Accenture, and LTIMindtree and our startup partners Dhvani AI, QuantHive, and Plenome.

Creative Corner

"While research drives us, creativity inspires us - here's a glimpse of talents beyond the lab"

Title: Bloom Again

One day, while walking through my campus, I came across a quiet pond filled with blooming water lilies. In the middle of that stillness, I noticed a small butterfly resting gently on one of the flowers. It was such a simple moment, but something about it stayed with me. I captured it, not just as a photo, but as a feeling. Later, I chose to bring that moment back to life through my digital art, drawn on a tablet I bought with my own hard-earned money. That, in itself, felt like a small victory, a reminder that growth comes step by step, through effort and patience. To me, this artwork is more than just a flower and a butterfly. It actually reflects life. Like the water lily, we grow through muddy waters, through struggles, doubts, and unseen challenges. And like the butterfly, we pause, we rest, we feel fragile at times. There are days of happiness and days of heaviness. Moments when everything feels still and moments when everything feels uncertain. But just like that bloom on the water, we rise again. No matter how many times life pushes us down, we learn, we heal, and we begin again. We wake up. We fight again. We keep moving forward. Because even in the quietest, simplest moments there is strength, there is beauty, and there is hope.

-Fakiha Rizvi

"Celebrating minds that think, create, and inspire."

Training Schedule

Title	Date	Register	Contact
Practical training in Phased Array UT/FMC/TFM	**May 04 - 08, 2026**		Dhanalakshmi. R Executive Secretary, CNDE, IITM. cnde.in@gmail.com Phone: 044 2257 5688 / 9940908831