CENTER FOR NON-DESTRUCTIVE EVALUATION

NDE VARTIKA

March-2025

NEWS LETTER OF CNDE

Faculty Featurette: Prof. Prabhu Rajagopal

Prof. Prabhu Rajagopal – A Visionary in NDE, SHM & Digital Transformation

The **Centre for Non-Destructive Evaluation (CNDE) at IIT Madras** takes immense pride in highlighting the exceptional contributions of **Prof. Prabhu Rajagopal**, a distinguished expert in Nondestructive Evaluation (NDE) and Structural Health Monitoring (SHM). Currently serving as the **Head of the newly launched School of Innovation and Entrepreneurship** at IIT Madras, Prof. Prabhu has consistently driven innovation that bridges the gap between cutting-edge research and real-world impact.

Trained at IIT Madras (BTech & DD MTech) and Imperial College London (PhD, Postdoc), Prof. Prabhu has led groundbreaking advancements in remote inspection technologies, digital asset integrity monitoring, and industrial digital transformation.

With over 30 funded projects, 200+ technical publications, and 40 granted IPs, Prof. Prabhu is at the forefront of research that is not only academically rigorous but also deeply impactful in industrial and societal contexts—ranging from energy and mobility to water, health, and sanitation. His contributions have been recognized with India's most prestigious award for mid-career scientists, the **Shanti Swarup Bhatnagar Prize for Science and Technology (2024)** under the Technology and Innovation category.

A firm believer in collaborative and cross-disciplinary research, Prof. Prabhu actively engages with leading global academic institutions and industry partners—particularly in the UK and Kenya—to drive innovation at scale. He is a founding member of several Centers of Excellence at IIT Madras, spanning Quantum Computing, Cybersecurity, Space Manufacturing, and Research on Startups & Risk Financing.

He also serves on the **Board of TECHIN**, the incubator of IIT Palakkad, and **on the Board of the Global Sanitation Center of Excellence (GCSIE)** at IIT Palakkad—two distinct institutions working toward sustainable innovation. Additionally, **he is the Chairman-elect of the ISNT Chennai Chapter** and is **taking over as Vice President of the Working Group 3 – 'Education and Research' at ICNDT**, furthering his influence in shaping the global discourse in NDE education and research.

Beyond academia, Prof. Prabhu is an entrepreneur at heart, co-founding pioneering startups that are redefining infrastructure maintenance and digital asset monitoring.

Prof. Prabhu's influence extends beyond research and startups—he plays a crucial role in nurturing the next generation of innovators. As the Faculty-in-Charge of the Center for Innovation (CFI) and the Nirmaan Pre-Incubator at IIT Madras, he is instrumental in shaping India's future tech leaders. He also served on the Editorial Boards of leading journals like Ultrasonics and NDT&E International, and as an advisor to various incubators and research hubs across the country.

His work has been widely featured in popular media, bringing NDE, SHM, and digital transformation into mainstream conversations. His journey reflects an inspiring blend of academic excellence, industry impact, and entrepreneurial spirit—a beacon for technology-driven societal progress.

We celebrate Prof. Prabhu's relentless pursuit of innovation and look forward to witnessing the transformative impact of his work in the years to come!

Collaborations/Lab Visits

An Insightful Evening with Dr. Kannan from Ex-IOCL at CNDE Lab!

The **Centre for Non-Destructive Evaluation (CNDE) at IIT Madras** had the privilege of hosting **Dr. Kannan**, **former Executive Director at Indian Oil Corporation Limited (IOCL),** for an engaging and insightful discussion on advancing industry collaborations.

With over 34 years of expertise in applied metallurgy, nano-technology, and pipeline transportation, **Dr. Kannan** has led groundbreaking R&D efforts in material failure analysis, remnant life assessment, and advanced NDE techniques. His visit provided a unique opportunity to exchange ideas on emerging trends in **Non-Destructive Evaluation (NDE)** and explore how industry-academia synergies can drive innovation forward.

Key discussions between **Dr. Kannan, Mr. V.Manoharan, Prof. Krishnan and Mr. Srijan** revolved around collaborative projects with the **National Consortium for NDE**, a key initiative spearheaded by CNDE, and potential industry applications of **TIQ World**, the next startup emerging from our ecosystem. **Dr. Kannan's** insights on product vision, industry expectations, and strategic direction were invaluable, offering guidance that will shape the future of our initiatives.

His visit reaffirmed the importance of fostering strong industry partnerships to bridge the gap between academic research and industrial impact. We sincerely thank **Dr. Kannan** for his time, encouragement, and mentorship, and we look forward to the exciting collaborations that lie ahead in transforming the NDE landscape.

ISRO Scientists at CNDE, IIT Madras

On February 26, 2025, the **Centre for Non-Destructive Evaluation (CNDE), IIT Madras,** had the privilege of hosting a distinguished team from the **Human Space Flight Centre (HSFC) – ISRO**. The visiting delegation included **Mr. Hari Krishna, Deputy Director of the Safety, Reliability, and Quality Area (SRQA)**, accompanied by **Shri B. Nagaraju and Shri Sudhir Shukla**, both esteemed scientists contributing to **India's space exploration journey.**

The visit began with **Prof. Prabhu Rajagopal** presenting an insightful overview of **CNDE's** cutting-edge work, with a special focus on ultrasonic waveguides for monitoring temperature and process parameters. Following this, **Prof. Balaji Srinivasan** shared ongoing research on fiber optic sensors capable of monitoring temperature, acoustic levels, and strain—technologies with potential significance for space missions and extreme environments.

The ISRO team explored the CNDE labs, witnessed ongoing research up close, and engaged with research scholars, exchanging thoughts and ideas that bridged academia and space-tech.

Moments like these remind us of the collaborative spirit driving India's research and innovation. From the lab benches at IIT Madras to the stars above with ISRO—this exchange marks another step in bringing precision and reliability to the forefront of national missions.

Paper Publications

At CNDE, the pursuit of knowledge never rests—and our latest publications are a testament to that spirit. Under the visionary guidance of Prof. Prabhu Rajagopal, who has been instrumental as the supervisor and co-author, our scholars continue to contribute high-quality research that bridges cutting-edge science with real-world applications.

Mr. Pandit's paper titled "Defect identification using sampling and outlier analysis in passive guided wave structural health monitoring" has been accepted by the Journal of Intelligent Material Systems and Structures. This work presents innovative approaches in guided wave-based SHM systems, with the potential to revolutionize defect detection across critical infrastruc-

Mr. Kairu's research, "Enhanced Structural Evaluation of Reinforced Concrete using first-generation Gamma Computed Tomography and Super-Resolution Imaging," has been accepted in NDT & E International. The paper explores advanced imaging techniques to push the frontiers of reinforced concrete evaluation.

These milestones reflect not just the scholarly excellence of our students, but also Prof. Rajagopal's unwavering mentorship, which continues to shape world-class research in the field of NDE. His leadership fuels a culture of curiosity, precision, and academic integrity.

New Research Scholars

Welcoming Amrita to the CNDE Research Community!

We are thrilled to welcome **Amrita**, a new **PhD student in the Interdisciplinary Research Programme at IIT Madras**, under the guidance of **Prof. Prabhu Rajagopal and Prof. Krishna Jagannathan**. Her research focuses on **Quantum Machine Learning and its applications, particularly in automated Weld Defect**

With a strong foundation in Pure Mathematics and Computational Sciences, Amrita holds an Integrated M.Sc. in Mathematics from the University of Mumbai and an M.Tech. in Computational and Systems Biology from MANIT Bhopal. Her research journey began with a thesis on Differentiable Manifolds under Prof. M. S. Raghunathan (FRS) and later expanded to Quantum Computing applications in Protein Folding, leading to a research paper currently under review.

Having also worked in Data Analytics & Automation at DELL Technologies, she brings a unique interdisciplinary perspective. Passionate about mathematical foundations and real-world applications of Quantum Machine Learning, she is eager to contribute to the CNDE ecosystem.

We look forward to her contributions and wish her success in this exciting journey!

Welcoming Dr. Udita Pant to the CNDE Research Community!

We are delighted to welcome **Dr. Udita Pant** as a **Postdoctoral Fellow at CNDE, IIT Madras**! She holds an M.Tech in Structural Engineering from IIT Roorkee and a Ph.D. from IIT Bombay, awarded under the prestigious Prime Minister's Research Fellowship (PMRF). Her expertise lies in **ultrasonic-guided waves, computational simulations, and advanced non-destructive evaluation (NDE) techniques**.

During her doctoral research, Dr. Pant focused on detecting damage in FRP-strengthened concrete structures using ultrasonic-guided waves, integrating numerical modeling (ABAQUS) with experimental testing. Her work spans wave propagation modeling, nonlinear ultrasonics, and advanced signal processing, particularly in analyzing how ultrasonic waves interact with structural defects.

At CNDE, she is now exploring Laser Ultrasonics and its potential applications in next-generation NDE technologies. With her strong interdisciplinary background, she is eager to collaborate with the team and contribute to groundbreaking research in ultrasonic evaluation.

We are excited to have her on board and look forward to her contributions. Wishing her the very best in this new journey!

Events/Conferences

"CNDE at NDE 4.0 – A Milestone Event Filled with Innovation, Collaborations & Great Conversations"

The **Centre for Non-Destructive Evaluation (CNDE), IIT Madras**, made a strong presence at the **3rd International Conference and Exhibition on NDE 4.0**, held in Bangalore. With a team of over 20 research scholars and project staff, CNDE actively participated in short courses, technical sessions, and insightful discussions on the latest breakthroughs in NDE 4.0. The event was truly comprehensive, with **Prof. Krishnan Balasubramanian (ISNT President & CNDE Head-In-Charge) delivering an insightful talk on Simulation-based ADR and Digital Twins for NDE**, setting the stage for the future of digital transformation in the field. A special highlight was the visit from **Dr. S. Somanath, Former ISRO Chairman**, who engaged with our research scholars and budding entrepreneurs, exchanging ideas that could shape the next wave of innovation.

One of the standout moments of the conference was **CNDE's presentation on the National Consortium for NDE (NCNDE)**—an initiative aimed at bridging the gap between academia and industry to drive innovation in non-destructive evaluation.

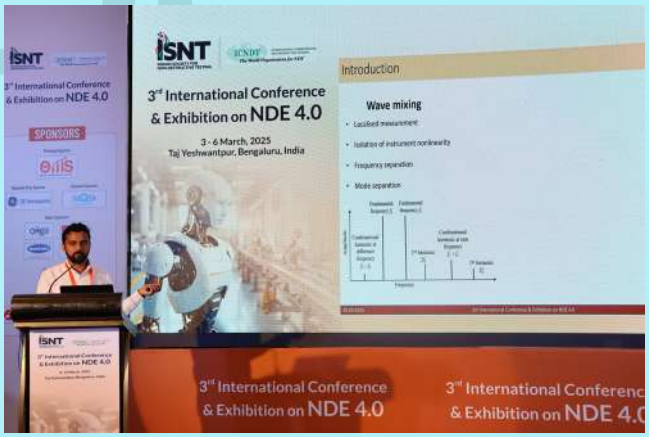
CNDE's contributions to the conference were marked by two invited talks and four technical paper presentations, covering groundbreaking research areas such as digital ecosystems, simulation-driven ADR, AI-assisted inspection, and nonlinear ultrasonics:

Invited Talks & Presentations

Prof. Krishnan Balasubramanian – Simulation-Based ADR and Digital Twins for NDE

Mr. Manoharan Venugopal – Digital Radiography: Image Quality Factors Impacting AI-Assisted Inspection

Mr. Srijan Tiwari – Enhancing NDE with Digital Ecosystems: Bridging Gaps in Procurement, Training, and Asset Management



Mr. Akhil Balachandran – Advanced Non-Destructive Evaluation of Nonlinearity in Isotropic Media Using Non-Collinear Wave Mixing.

Beyond the technical sessions, the conference provided an invaluable platform for collaborating with industry leaders, academic researchers, and technology experts, all working toward shaping the future of NDE in the Industry 4.0 era.

CNDE extends its gratitude to the event organizers for a well-orchestrated conference and looks forward to furthering its contributions to this ever-evolving field.

Special section: NDE Beyond Research

Our Scholar inspiring the Next Generation at Bangalore Technological Institute!

A moment of pride, inspiration, and electrifying energy as our **research scholar Srijan Tiwari** was invited as the Chief Guest at **Bangalore Technological Institute (BTI)** and its Incubation Centre to deliver a talk on the Role of AI/ML in Indian Startups & Innovation Landscape.

The event was a vibrant exchange of ideas, where students, aspiring entrepreneurs, and faculty gathered to discuss entrepreneurship, product-building challenges, and industry disruptions. The overwhelming turnout and enthusiasm in the room reflected the growing interest in AI-driven innovation. A key highlight of the session was engaging with young innovators, answering thought-provoking questions, and exploring the inter-section of AI, ML, and NDE applications.

The event concluded with a special recognition for the speaker, honoring their contributions to industry and mentorship, and leaving a lasting impact on the BTI Incubation ecosystem.

**** The End ****