

e-STRUCT

e-Newsletter of CSIR-Structural Engineering Research Centre

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Research highlights

Nonlinear ultrasonics for early-stage damage monitoring in structures

Nondestructive evaluation (NDE) comprises inspection methods used to assess the condition of structures without causing damage to the structure. Conventional NDE techniques, such as ultrasonic pulse velocity, radiography, and visual inspection, are effective for identifying visible or macroscopic defects but have limited sensitivity to early-stage microstructural damage like micro-cracks, fatigue, and material degradation. To address this gap, nonlinear ultrasonics (NLU) has emerged as an advanced approach that leverages nonlinear interactions between elastic waves and material defects. Unlike linear ultrasonic methods that assume elastic material behavior and focus on wave speed and attenuation, NLU analyzes nonlinear phenomena such as higher harmonic generation, frequency mixing, and sideband modulation. These features are highly sensitive to subtle material changes, enabling earlier detection of damage and supporting structural health monitoring.

At CSIR-SERC's Special and Multifunctional Structures Laboratory (SMSL), researchers integrate experiments, signal processing, and computational methods to develop practical NDE solutions for reinforced concrete, composite systems, and infrastructure components. Their studies show that nonlinear ultrasonic indicators, particularly sideband peak count indices

(SPC) detect micro-crack initiation and damage progression in reinforced concrete at early stage more reliably than conventional linear parameters. The team has also applied NLU to identify interface flaws in FRP-concrete composites using Rayleigh wave-based nonlinear responses, improving defect detection in complex layered systems.

Monitoring concrete curing

Concrete, as a highly heterogeneous composite, has been evaluated using methods ranging from advanced physicochemical characterization to mechanical testing. Physicochemical tests are limited to small samples and do not reliably represent large structures, while core-based mechanical tests are often impractical or restricted in real structures. This makes nondestructive testing and evaluation (NDT&E) especially attractive, though challenging. Numerous NDT&E methods have been explored for concrete, including ultrasonic pulse velocity, rebound hammer, pulse-echo, ground-penetrating radar, electro-mechanical impedance, infrared thermography, acoustic emission, and terahertz techniques. Among these, acoustic and ultrasonic wave-based methods are particularly suitable for large structures, continuous monitoring, and detection of small damage. However, strong wave attenuation in heterogeneous



The e-STRUCT newsletter showcases a journey of continued resilience in the quarter gone by, coupled with optimism for a better future through the scientific activities and myriad events that are part of day-to-day life on the CSIR-SERC campus. I am very happy to present Vol. 9, No. 4, 2025 issue of e-STRUCT. This edition showcases the varied skills of the CSIR-SERC community, highlighting our R&D pursuits, achievements, skill development initiatives, and other significant events & endeavours during October-December 2025.

The research highlights of this issue give a brief on the work being carried in CSIR-SERC on nonlinear ultrasonics as an advanced approach for early-stage damage monitoring in structures. The techniques developed are useful for development of smart, slim and sustainable infrastructure development and shall serve industries such as civil infra, railways, highways and nuclear power plant structures. Four new technologies were developed at CSIR-SERC, namely, HyThermSlim: Thermo-mechanical hybrid simulation platform for structural testing, Fly ash and limestone calcined clay-based mixtures for concrete 3D printing, Floating platform for hybrid offshore horizontal axis wind turbine (HAWT) & solar farm, and Floating offshore hybrid energy platform.

An MoU was signed with National Automotive Test Tracks (NATRAX), Madhya Pradesh, for the project on Sustainable material design, development of sustainable materials for structures and tracks, knowledge exchange and training. Memoranda of understanding were signed with five reputed academic institutions for academic and research collaboration, during this quarter. As in earlier quarters, skill development programs and Jigyasa events were organized. CSIR-SERC participated in three exhibitions namely, Bengaluru Tech Summit 2025, CII Global Summit on Technology, R&D & IP 2025, New Delhi and Aspiring Mysore 2025, and showcased its various technologies. A total of twelve papers were published in this quarter, of which eight were in SCI Journals and four in reputed Indian Journals. This has indeed been a challenging but eventful quarter and as always, we look forward to more exciting opportunities in future.

With best wishes,

Dr. N. Anandavalli

18.3.2026

concrete makes frequency selection critical. Ultrasonic testing operates mainly in simple and multiple scattering regimes, avoiding low-frequency vibration modes and high-frequency attenuation-dominated ranges.

Conventional ultrasonic methods are linear, relying on time-of-flight and attenuation under the assumption of linear stress-strain behaviour. In contrast, nonlinear ultrasonics accounts for material nonlinearity caused by micro-crack opening-closing and inter-particle bonding effects, which induce stress-dependent stiffness changes. Nonlinear indicators such as harmonics, modulation products, coda waves, amplitude-dependent resonance, and sideband peak counts are far more sensitive to early-stage damage. These techniques have proven effective for detecting fatigue, corrosion, chemical degradation, and thermal aging in cement-based and composite materials.

Concrete is made of particles, voids and interfaces. The characteristics of concrete that evolves during curing is dependent on factors such as constituents of materials and micro-cracks and environmental parameters such as water to cement ratio and temperature. As mentioned above, due to the multiscale nature (length scale of the constituents/phases varies from centimeters to micrometers) and change in phase over time. It is a challenging task to develop an appropriate ultrasonic technique which can reflect the change in state of concrete during different stages of curing. The mechanical properties such as elastic modulus (E0) reflect the composite properties of all the constituents. The constituents and their interfaces bring the nonlinearity in the Young's modulus (E) due to the disturbance (strain) created during propagation of the elastic wave in the medium.

$$E(\varepsilon, \dot{\varepsilon}) = E_0(1 - \beta\varepsilon - \alpha(\Delta\varepsilon + \text{sign}(\dot{\varepsilon})\varepsilon))$$

where β is the classical nonlinearity, α the nonclassical nonlinearity, ε is the instantaneous strain and $\dot{\varepsilon}$ is the strain rate. It is evident that the classical nonlinearity (β) reflects the change in wave velocity due to the change in strain state in the medium. The nonclassical nonlinearity (α) represents the hysteresis behavior of heterogeneous materials. Thus, the nonlinear ultrasonic technique can be potentially applied to understand the internal changes of concrete. The concept of SPC and its performance as an indicator for concrete curing is shown in Fig. 1.

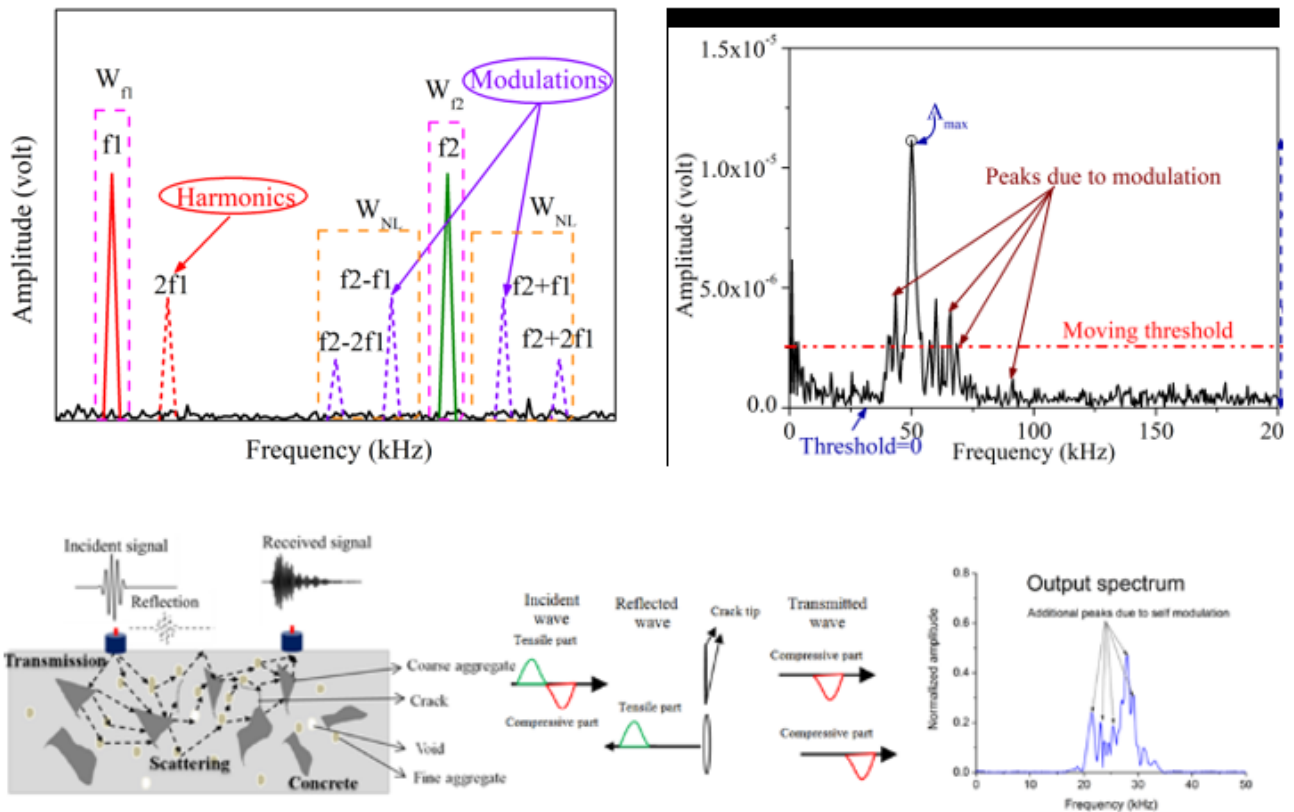


Fig. 1 Nonlinear ultrasonics - powerful technique for early-stage assessment

In this investigation two different mix designs with different w/c ratios were considered to investigate that whether linear and nonlinear ultrasonic parameters can show consistent variation with curing time for both sets of specimens, and if these parameters are sensitive enough to capture the differences in the curing process for these two different mix designs. It is found that the most popular linear ultrasonic parameter, the ultrasonic pulse velocity, is found to be not very efficient for monitoring concrete curing and attenuation variation of propagating ultrasonic signals is also not reliable for concrete curing monitoring. The non-linear SPC technique is found to be very effective in monitoring the curing of concrete (Fig. 2).

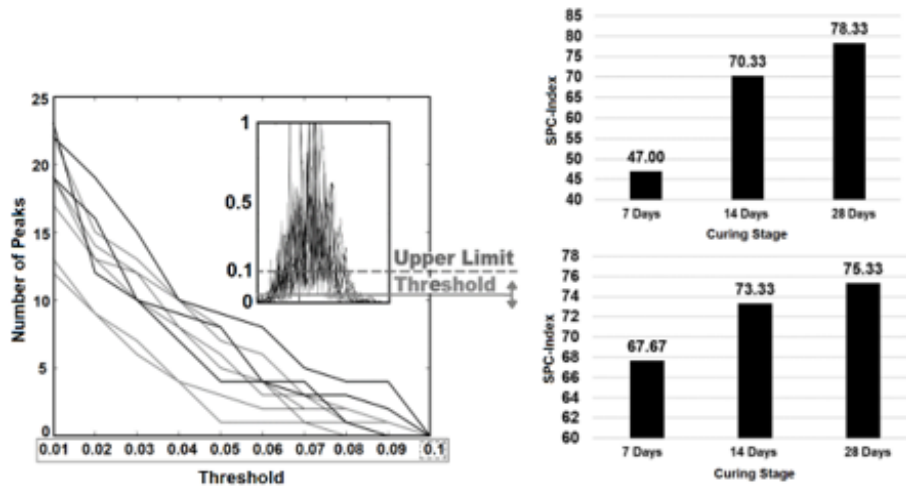


Fig. 2 Monitoring concrete curing using nonlinear ultrasonic features

Monitoring stress-induced damage in reinforced concrete structures

In reinforced concrete (RC), material nonlinearity is evident even in its undamaged state due to the inherent microstructure. In the present work, damage progression in RC structure at different levels of damage is investigated using linear and nonlinear ultrasonic techniques. The primary focus of this study is to monitor the structure from its initiation stage(s) of damage to advanced stages. Ultrasonic velocity tomography is first implemented to identify the weaker regions and map any damage occurring at various levels of loading. Two critical regions are identified from ultrasonic tomography and further damage characterization is carried out using various ultrasonic techniques to quantitatively assess the progression of damage in these two regions. The linear ultrasonic techniques such as time-of-flight (TOF) and attenuation, and the nonlinear ultrasonic techniques such as sub- and super- harmonic, energy distribution, etc. are employed to detect the damage progression. It is found that the changes in linear parameters due to damage progression in RC structure are often insignificant and inconsistent. However, some of the nonlinear ultrasonic techniques are found to be very efficient to monitor the damage progression. A relatively new and promising nonlinear ultrasonic technique, namely the sideband peak count-index (or SPC-I) provides a very clear and consistent indication of damage at the early stage. The present study shows that during the initial stages of damage, SPC-I based nonlinear technique performs significantly better (at both regions as identified through ultrasonic tomography) than other linear and nonlinear techniques, whereas at higher damage stage the superiority of this nonlinear ultrasonic technique slowly diminishes. The present study also shows that out of all nonlinear ultrasonic techniques considered here, SPC-I technique provides the highest sensitivity to the damage progression and can be effectively used as a very robust nonlinear ultrasonic tool for identifying the onset and progression of damage in RC structures (Fig. 3).

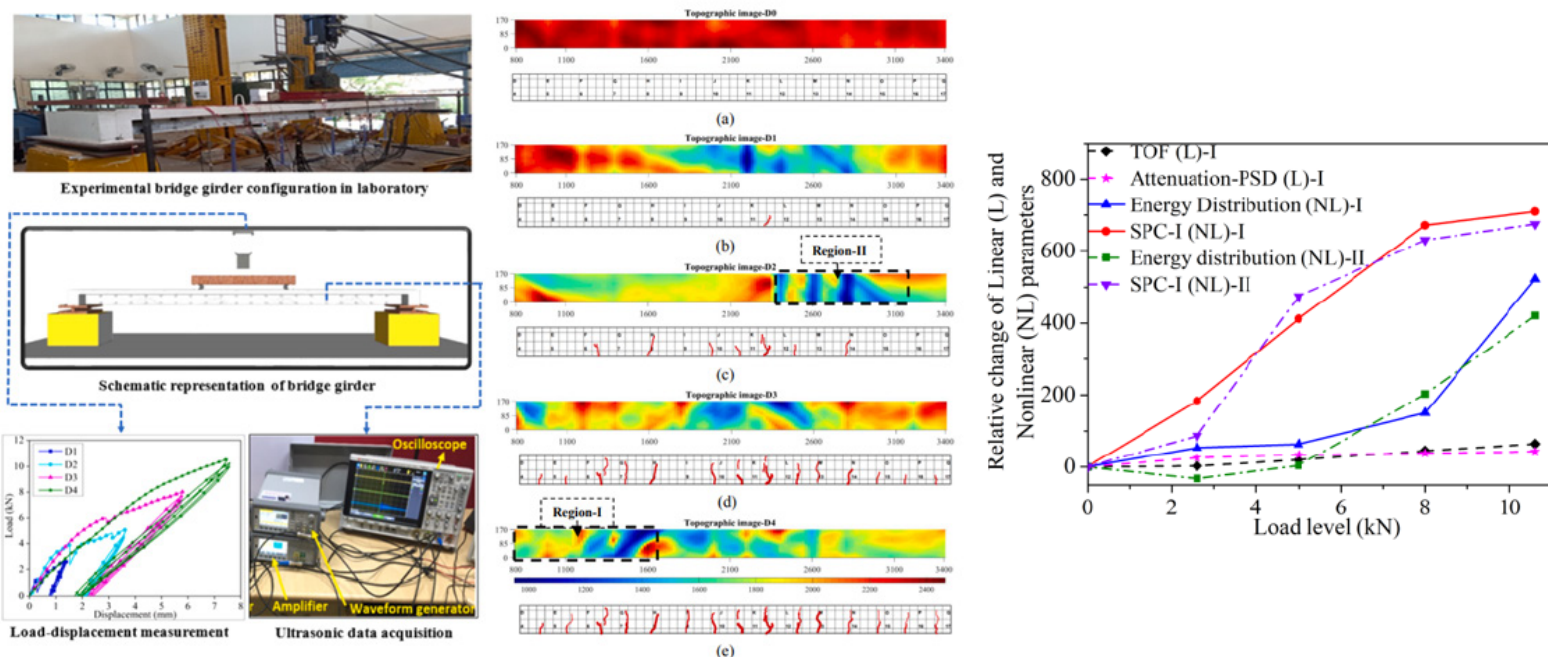


Fig. 3 Monitoring stress-induced damage using nonlinear ultrasonic features

The critical observations made from the present study on the detection of damage in RC structures using linear and nonlinear ultrasonic techniques are, (i) Ultrasonic velocity map obtained using tomography technique has enabled the identification of weaker regions at various levels of loading, (ii) Two linear parameters (wave velocity and attenuation) are found to have similar levels of sensitivity to the damage progression. Though the attenuation parameter defined in terms of power spectral density shows good sensitivity at the early stage of damage, it loses its sensitivity at higher damage levels, i.e., this parameter gets saturated at relatively low damage level, (iii) Both sub- and higher- harmonics are found to be difficult to detect. The applied voltage (50 Vpp) may not be sufficient for harmonic generation in this case which made them inapplicable, (iv) When sideband peaks are analysed, it is found that the generation of peaks due to nonlinearity occurs mainly within 1-20% of the maximum peak amplitude and the nonlinear techniques based on the occurrence of sidebands such as energy distribution, SPC-I are found to provide most promising results to monitor load induced micro-damages, and (v) It is found that results of energy distribution and SPC-I techniques applied in two critical regions are consistent and this assures the robustness of these nonlinear parameters in quantifying the degree of damage for every load level with good precision which is useful for getting the higher-level damage warning well before it occurs.

Detection of initiation of corrosion induced damage in concrete structures

Structural failure due to corrosion of reinforcing steel in concrete structures is quite common. In most cases, corrosion cracks appear on surface at a later stage, thus not providing adequate time for taking any measure. This investigation focusses towards the detection of corrosion damage in reinforced concrete elements by using non-linear ultrasonic techniques. Various linear and nonlinear ultrasonic (LU & NLU) techniques were adopted to identify corrosion induced damage at its early stage. It is observed that the linear techniques are not very effective in detecting corrosion induced damage. Sideband peak count-index (SPC-I), a relatively new and promising technique, has been found to be an excellent indicator for detection of corrosion induced damage initiation. However, its efficacy for detecting corrosion induced damage has not been reported yet. The present study shows that the SPC-I based NLU technique outperforms (with highest sensitivity) all other NLU techniques for detecting the on-set of corrosion in steel and micro-crack formation in the surrounding material. As the corrosion progresses and crack appears on the surface of the concrete, efficiency of the SPC-I slowly weakens and other technique(s) are found to be quite efficient at that stage (Fig. 4). The study demonstrates that early-stage micro-cracking caused by reinforcement corrosion in reinforced concrete (RC) structures can be detected before visible surface cracks appear. Strong nonlinear signatures emerge in ultrasonic signals as corrosion-induced damage initiates, with pronounced changes observed in nonlinear parameters derived from the sideband peak count index (SPC-I) in the frequency domain.

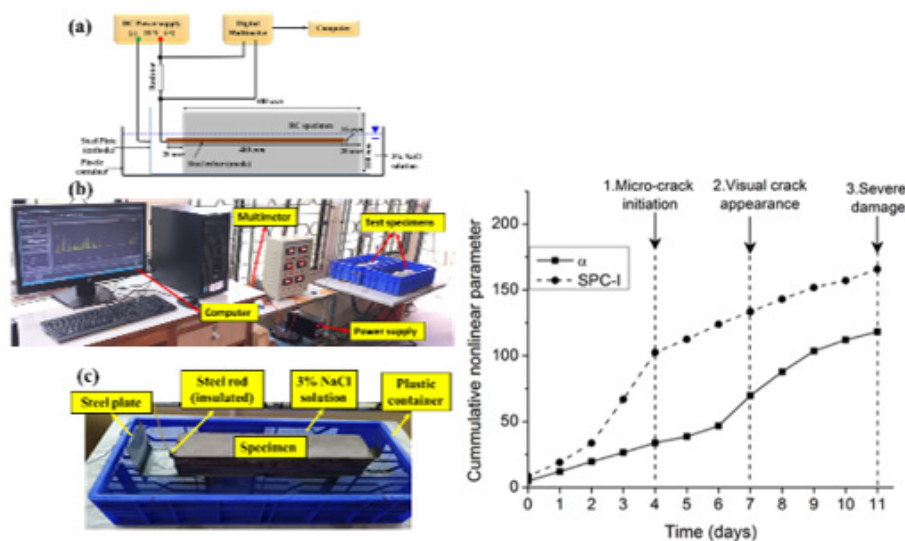


Fig. 4 Monitoring corrosion-induced damage using nonlinear ultrasonic features

An energy-based nonlinear parameter also increases as damage progresses, but this change typically becomes evident only around the time when surface cracks become visible. In contrast, conventional linear ultrasonic indicators, such as time-of-flight (TOF) and attenuation show much lower sensitivity to these early microstructural changes. Among the evaluated metrics, SPC-I proves to be the most effective and sensitive indicator for identifying the onset of corrosion inside concrete, capturing micro-crack formation that remains invisible at the surface and is difficult to detect using other techniques. The results also reveal an interesting post-damage behaviour: following significant micro-cracking events, nonlinear parameters may return towards baseline values. This recovery is attributed to possible filling of crack voids by corrosion products or further crack opening that reduces overall nonlinearity. Building on these findings, ongoing experimental work aims to develop a unified model capable of tracking corrosion-induced damage in RC structures from initiation through to final failure.

Detection of interface flaws in concrete-FRP composite structures

Timely retrofitting is crucial in maintaining the safety and sustainability of aging concrete structures. Fiber Reinforced Polymer (FRP) composites are increasingly used for this purpose due to their high strength, durability, and corrosion resistance. The effectiveness of FRP retrofitting depends largely on the integrity of the bond between the FRP layer and the concrete substrate; even small interface flaws can significantly compromise the structural performance. This study investigates the early detection of defects at the FRP-concrete interface using ultrasonic wave-based methods. Artificial flaws of varying sizes were introduced into the epoxy adhesive layer of carbon FRP-strengthened concrete beams. This study investigates the use of ultrasonic Rayleigh waves to detect interface damage in concrete-FRP composite beams, where defects are located within the adhesive layer. Wave propagation in such composites is complex due to the presence of multiple heterogeneous media with different mechanical properties. Experiments were conducted using Rayleigh waves at two excitation frequencies (75 kHz and 250 kHz), and response signals were analyzed in the time, time-frequency, and frequency domains to extract both linear and nonlinear damage indicators. Both linear and nonlinear ultrasonic signal processing techniques were applied, supported by numerical simulations to better interpret wave interactions within the layered composite medium.

The results show that linear ultrasonic parameters exhibit complex and method-dependent behaviour. Time of flight (TOF) trends vary based on how TOF is calculated: measurements taken from the initial signal onset or first wave packet peak show a general decrease with increasing damage (indicating faster apparent wave speeds), whereas TOF based on the maximum peak shows an opposite trend, with increased TOF in damaged beams. Numerical simulations support this non-intuitive behaviour arising from wave interactions in heterogeneous layered media. Attenuation can indicate damage across stages when the excitation wavelength smaller than the defect size; however, high-frequency signals require careful denoising to avoid losing meaningful features. Nonlinear ultrasonic methods demonstrate significantly higher sensitivity of approximately 8 to 14 times greater than linear parameters at both excitation frequencies (Fig. 5). Among these, the sideband peak count index (SPC-I) performs consistently well across all damage levels and frequencies, making it the most robust indicator. The sideband energy ratio (SER) is effective for later-stage damage but less sensitive to early damage at low frequencies. Overall, the study recommends using SPC-I alone or in combination with SER under low-frequency excitation to reliably monitor damage progression while minimizing excessive scattering and energy loss.

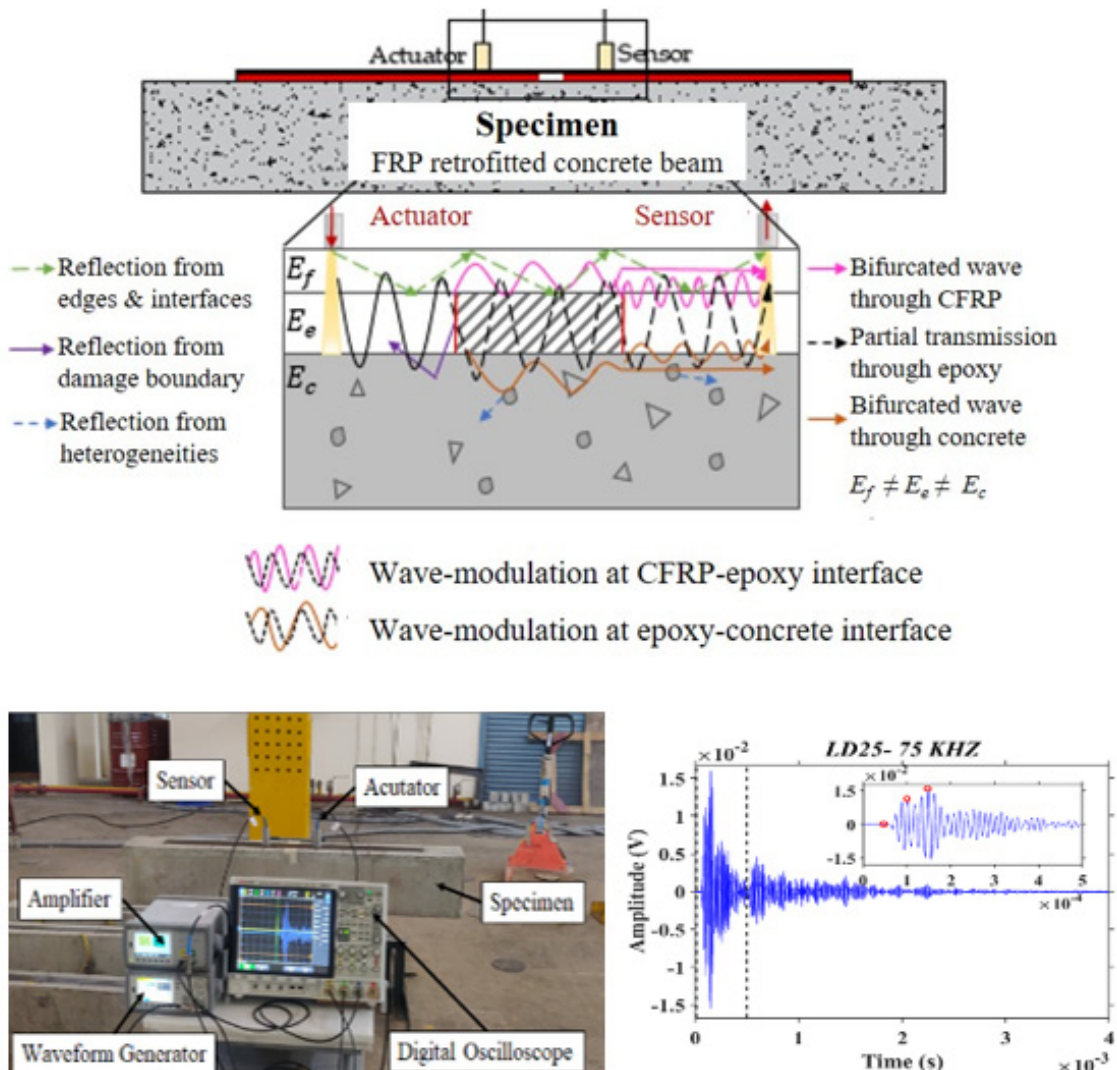


Fig. 5: Detection of FRP-concrete interface flaws using nonlinear ultrasonic features

Major Projects Undertaken

- Feasibility studies on the lowering of the gas pipeline and devising the lowering methodology
- Performance assessment of Open Web Girder Bridge No.162 between Agra Fort Yamuna Bridge Station at Agra (UP) through instrumentation and field testing
- Condition assessment of civil structures of main plant at Kaiga Generating Station 1 and 2
- Vibration qualification tests of Mast Hoisting Gear (MHG) System using 30T 4m x 4m shake table test facility
- Seismic performance assessment of instrument transformer using shake table
- Detailed inspection of one unit boiler structures of TPS-II and 14A/14B conveyor of LHS - Phase I
- Condition assessment of TG Foundation Deck, ID, FD, PA Fan & Mill Foundations of Stage-II and Stage-III, NTPC Rihand Nagar
- Condition assessment and rehabilitation of reinforced concrete IDCT cooling towers - stage 1 and stage 2 of NTPC Mouda
- Seismic qualification of G+2 frame structure with Zmart Build wall using shake table
- Instrumentation and response measurement during load testing of steel concrete composite girder and PSC girders for Southern Railway
- Condition assessment of coke drum supporting RC structure
- Condition assessment of Zoological Survey of India building located at Santhome in Chennai and recommendation for remedial measures
- Condition assessment of steel structures in CHP area of NTPC, Mouda
- Evaluation of shear and flexural behavior of corrugated web girders (Sin Beams)
- Fatigue life evaluation of trimetallic flash butt welded rail joints

MoUs/Technology transfers

1. A memorandum of understanding (MoU) between CSIR-SERC and National Automotive Test Tracks (NATRAX), Madhya Pradesh, was signed for the project on **Sustainable material design, development of sustainable materials for structures and tracks knowledge exchange and training**, on 8 October 2025



2. The memoranda of understanding (MoU) was signed between CSIR-SERC and the following academic institutions for Academic and Research Collaboration, during October - December 2025:

1. National Institute of Technology, Tiruchirapalli (NIT-T)
2. Sri Sivasubramaniya Nadar College of Engineering (SSNCE), Chennai
3. SRM Easwari Engineering College, Chennai
4. Panimalar Engineering College, Chennai
5. School of Civil Engineering, Vellore Institute of Technology, Chennai



3. Textile Reinforced Concrete Boundary Wall Panels and Precast Drains, a technology of CSIR-SERC, was licensed to M/s. L&T Construction (Transportation Infrastructure CI), Mumbai, on 3 October 2025

4. Portable Lightweight Foldable Module for Make Shift Hospitals and other Needs Polital (M), a technology of CSIR-SERC, was licensed to M/s. Sehgal Doors, New Delhi, on 18 October 2025



Capacity development

Seminar on Earthquake safety of precast and prefabricated structures

A one-day seminar on **Earthquake safety of precast and prefabricated structures** was organized in hybrid mode by CSIR-SERC on 26 November 2025. About 270 participants registered online and more than 50 participants attended the seminar in the venue. The opening remarks for the seminar were given by Dr. P. Kamatchi, Chief Scientist, CSIR-SERC. A brief overview of the technologies developed by CSIR-SERC focusing on the contributions made in precast sector were highlighted by Dr. N. Anandavalli, Director CSIR-SERC and Coordinating Director, CMC.

It was followed by ten talks from distinguished speakers spanning academia, research and industry. Dr. Pinar Okumus, Associate Professor from University at Buffalo and Prof. Yogendra Singh from IIT Roorkee presented the current state of art research in precast structures from earthquake safety point of view. Shri. Yogesh Kajale from BG Shirke Construction, Shri. Prasad CA from Metey Engineering and Consultancy, Shri. Amit Barde from L&T Construction and Shri. S. Sathiyaseelan from Teemage Precast In, delivered talks related to challenges and opportunities of precast construction in India, highlighting the imperative need of shifting from conventional construction practices for catering to rapid infrastructural growth. Dr. G.V. Rama Rao, Principal Scientist, CSIR-SERC, shared the details about the laboratory tests conducted at CSIR-SERC on precast concrete shear walls and precast joints. Dr. Mohit Verma, Principal Scientist, CSIR-SERC and Dr. C. Bharathi Priya, Senior Principal Scientist, CSIR-SERC, explained about the full-scale testing facilities at ASTaR Laboratory of CSIR-SERC, including the lateral load testing capability of precast buildings upto G+2 storeys. The speakers also participated in the panel discussion moderated by Dr. N. Gopalakrishnan, Former Director, CSIR-Central Building Research Institute (CBRI), Roorkee, who summarized the key takeaways from the seminar to set the roadmap for future of seismic testing, standardization and construction of precast structures.



Advanced Courses

An advanced course on **Seismic Engineering and Testing (SET 2025)**, was held during 7-9 October 2025, at CSIR-SERC. The participants from Government organizations & public sector organizations, private sector organizations, academicians and research scholars attended the course.

An advanced course on **Wind Loads and Effects on Structures (WiLES 2025)**, was held during 17-19 December 2025, at CSIR-SERC. The spectrum of participants included engineers from government sector, private sector, public sector undertakings, educational institutions and industry with civil and structural engineering background. There was nearly equal participation from industry and academia.



Jigyasa

CSIR JIGYASA ATL Workshop - A two day workshop was organized during 15-16 October 2025, exclusively for the students of the adopted schools in Krishnagiri district of Tamil Nadu. Seven Scientists and one Technical Officer of CSIR-SERC and CMC visited the schools and delivered lectures on topics related to basic science, latest scientific advancements, smart building and bridges, etc., and also witnessed the facility created under the ATL program. About 450 students and 15 teachers participated in the workshop.

Government Higher Secondary School, Keelkuppam and Government Boys Higher Secondary School, Shoologiri, Krishnagiri District

- Dr. S. Maheswaran, Senior Principal Scientist, CSIR-SERC, delivered a lecture on **Introduction to CSIR-SERC, CSIR JIGYASA ATL Workshop and Hands-on Session and Intellectual Property Rights**
- Dr. A. Abraham, Senior Principal Scientist, CSIR-SERC, delivered a lecture on **Response of Buildings and Structures under Wind Action**
- Dr. T. Hemalatha, Principal Scientist, CSIR-SERC, delivered a lecture on **Climate Change and Civil Engineering**
- Dr. G. Saravanan, Principal Scientist, CSIR-NEERI (Chennai Unit), delivered a lecture on **Pollution and its Control**

Government Boys Higher Secondary School, Royakottai and Government Higher Secondary School, Pavakkal, Krishnagiri District

- Shri E. Ashok Kumar, Senior Scientist, CSIR-SERC, delivered a lecture on **Introduction to CSIR-SERC, CSIR JIGYASA ATL Workshop and Hands-on Session**
- Dr. A. Mercy Latha, Senior Principal Scientist, CSIR-CEERI (Chennai Unit), delivered a lecture on **Everyday Application of the Electromagnetic Spectrum**
- Dr. S. Sundar Kumar, Principal Scientist, CSIR-SERC, delivered a lecture on **Earthquakes and Building**
- Shri R.D. Sathish Kumar, Principal Technical Officer, CSIR-SERC, delivered a lecture on **Intellectual Property Rights - Introduction**



CSIR JIGYASA ATL Workshop - A two day, CSIR JIGYASA ATL workshop was organized during 6-7 November 2025, exclusively for the students of the adopted schools in Dharmapuri districts of Tamil Nadu. About 336 students and 14 teachers were participated in the workshop.

Government Higher Secondary School, Karimangalam, Dharmapuri District

- Dr. S. Parivallal, Advisor (Management), CSIR-SERC, delivered a lecture on ***Bridges in the Journey of Human Civilisation***
- Dr. S. Maheswaran, Senior Principal Scientist, CSIR-SERC, delivered a lecture on ***Introduction to CSIR-SERC, CSIR JIGYASA ATL Workshop, Hands on Session and Intellectual Property Rights on Overview***
- Dr. A. Abraham, Senior Principal Scientist, CSIR-SERC, delivered a lecture on ***Response of Buildings and Structures under Wind Action***

Government Higher Secondary School, Kambainallur, Dharmapuri District

- Dr. G.S. Ayyappan, Senior Principal Scientist & SIC, CSIR-CSIO (Chennai Unit), delivered a lecture on ***Climate Changes - Mitigation through Energy Conservation and Efficiency***
- Dr. S. Sundar Kumar, Principal Scientist, CSIR-SERC, delivered a lecture on ***Introduction to CSIR-SERC, CSIR JIGYASA ATL Workshop, Hands on Session and Earthquakes and Buildings***
- Shri A.K. Farvaze Ahmed, Principal Scientist, CSIR-SERC, delivered a lecture on ***Role of Physics and Chemistry in Civil Engineering***
- Shri R.D. Sathish Kumar, Principal Technical Officer, CSIR-SERC, delivered a lecture on ***Introduction to Artificial Intelligence***

Government Girls Higher Secondary School, Harur, Dharmapuri District

- Dr. S. Maheswaran, Senior Principal Scientist, CSIR-SERC, delivered a lecture on ***Introduction to CSIR-SERC, CSIR JIGYASA ATL Workshop, Hands on Session and Intellectual Property Rights on Overview***
- Dr. A. Abraham, Senior Principal Scientist, CSIR-SERC, delivered a lecture on ***Response of Buildings and Structures under Wind Action***
- Shri A.K. Farvaze Ahmed, Principal Scientist, CSIR-SERC, delivered a lecture on ***Role of Physics and Chemistry in Civil Engineering***

Government Secondary School, Theerthamalai, Dharmapuri District

- Dr. G.S. Ayyappan, Senior Principal Scientist & SIC, CSIR-CSIO (Chennai Unit), delivered a lecture on ***Climate Changes - Mitigation through Energy Conservation and Efficiency***
- Dr. S. Sundar Kumar, Principal Scientist, CSIR-SERC, delivered a lecture on ***Introduction to CSIR-SERC, CSIR JIGYASA ATL Workshop, Hands on Session and Earthquakes and Buildings***



Visit of Science and Mathematics Teachers - A group of 45 science and mathematics teachers from Kendriya Vidyalaya, Jawahar Navodaya Vidyalaya, and AECS schools across the southern region and four officials from Vigyan Pratibha Team, Institute of Mathematical Sciences, Taramani, visited the CSIR-SERC, Chennai on 19 November 2025. During the visit, the teachers visited the various advanced laboratories, interacted with scientists, and observed ongoing research projects in structural engineering and related disciplines. The visit served as a valuable bridge between school education and front-line scientific research, helping teachers bring real-world scientific perspectives back to their classrooms.

Participation in exhibitions

CSIR-SERC participated in the 28th edition of Asia's largest tech event - **Bengaluru Tech Summit 2025** held at BIEC, Bengaluru, during 18-20 November 2025. The indigenous technologies were showcased during the summit to diverse set of visitors who included government officials, business executives from infrastructure sector, startup CEOs and students etc. Visitors have shown keen interest in technologies such as Emergency Retrieval System for transmission line towers, Concrete 3D Printing, Multi-Hit Resistant Protective Booth etc. Many business visitors interacted about the R&D behind these technologies and avenues for future collaboration

CSIR-SERC showcased its cutting-edge technologies and world-class facilities at **CII Global Summit on Technology, R&D & IP 2025**, held at New Delhi during 16-17 December 2025. The exhibition attracted a diverse audience.

CSIR-SERC showcased its cutting-edge technologies and world-class facilities at **Aspiring Mysore 2025**, held at Mysore during 18-20 December 2025. The exhibition attracted a diverse audience, including government officials, industry leaders in the infrastructure sector, and students. Hon'ble Member of Parliament Mysore Mr. Yaduveer Krishnadatta Chamaraja Wadiyar visited the exhibits of CSIR-SERC.



Special lectures by visitors

- Professor Bathasar Novak, University of Stuttgart, Germany, visited CSIR-SERC on 1 December 2025 and delivered the technical lectures titled **Strengthening strategies for existing concrete bridges** and **Distributed fiber optic sensors (DFOS) for long term monitoring of existing bridges - development and experiences** and visited all laboratories of CSIR-SERC.
- Professor Tribikram Kundu, Civil and Architectural Engineering and Mechanics Department, University of Arizona, USA, visited CSIR-SERC on 22 December 2025 and delivered a technical lecture titled **SPC-I and DPSM - two new developments in the fields of NDE and SHM**. He also visited all laboratories and interacted with the scientists of CSIR-SERC.



Events

One Day Workshop on Intellectual Property Rights was organized on 23 October 2025, at CSIR-SERC. Dr. T. Pavan Kumar, Principal Scientist, Chemistry & IPR, CSIR-Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar, conducted the sessions. Dr. N. Anandavalli, Director, CSIR-SERC, presided over the event and gave welcome address, in which, she briefed on the significance of intellectual property and the need to protect it.

The workshop was organized into two sessions. The first session covered topic such as Innovation dynamics & IPR - idea to implementation (I2I), Anatomy of patents - structure, scope & significance (3S), Patentability assessment criteria, Commonality & categorization (3C), Patent search - databases & demonstration (2D). The second session included topics such as Patent drafting - the CLAIM game, Patent filing - fees, forms & formalities (3F) and IP commercialization - mind to monetization (M2M). More than 100 scientists and technical officers participated in the workshop. The workshop was coordinated by Shri R.D. Sathish Kumar, Principal Technical Officer & Convenor IPM Cell, CSIR-SERC.



Vigilance Awareness Week 2025 was observed from 27 October to 2 November 2025 at CSIR-SERC, as part of three-month campaign from 18 August to 17 November 2025. The theme of observing Vigilance Awareness Week this year was **Vigilance: Our Shared Responsibility**. Various activities were organised viz., essay writing & drawing competition for school children, quiz competition, lecture and slogan writing for staff members. A Hindi lecture was delivered by Dr. P. Rajaretnam, Professor, Central University of Tamil Nadu, Tiruvarur. The Integrity pledge was taken 27 October 2025.

Special Campaign 5.0 for improving swachhata and disposal of pending reference was organized during 2-31 October 2025. As a part of this campaign, cleanliness drive was organised by the staff members at Perungudi Railway Station premises.

Curtain Raiser to National Tamil Science Conference NTSC 2026 was organized at CSIR-SERC on 12 November 2025. The National Tamil Science Conference (NTSC 2026) is being organized during 20-22 February 2026, jointly by Arival Sangam, Tamil Nadu and CSIR-Structural Engineering Research Centre (CSIR-SERC), at CSIR-SERC, Chennai. The theme of the conference is Sustainable Development in Science and Technology and it is a unique platform dedicated to promoting science, technology, and innovation through the Tamil language. This prestigious event will bring together eminent scientists, academicians, industrial leaders, policy makers, and students to deliberate on the latest advancements in various scientific domains.

Curtain Raiser of the India International Science Festival (IISF) 2025 was held at CSIR-SERC, Chennai on 20 November 2025, marking an important step towards generating nationwide awareness and enthusiasm for IISF 2025, reaffirming the commitment to fostering scientific spirit and public outreach. The Curtain Raiser highlighted the theme of **Vigyan Se Samruddhi: For Aatmanirbhar Bharat**, emphasizing India's leadership in science, technology, innovation, and societal applications. The staff members of CSIR-SERC and students from PM Shri Kendriya Vidyalaya, Meenambakam, Chennai, actively participated in the event.

Dr. S. Gomathinayagam, Former Director General, National Institute of Wind Energy, Chennai, attended the programme as Chief Guest. Dr. N. Anandavalli, Director, CSIR-SERC, gave welcome address. Two technical lectures were organized as a part of the event. Dr. C. Bharathi Priya, Principal Scientist, CSIR-SERC delivered the lecture on **Shakes & Shapes: Earthquake and Structures** and Dr. M. Keerthana, Principal Scientist, CSIR-SERC delivered a lecture titled **Wind Effects on Structures**.

An overview of the objectives and planned activities of IISF 2025 were presented by Dr. S. Maheswaran, Senior Principal Scientist, CSIR-SERC, who emphasized the festival's role in promoting scientific temperament, innovation, and youth participation across the country. A promotional video on IISF was also played during the event. Following the sessions, students visited the Advanced Seismic Testing Research Laboratory and the Wind Engineering Laboratory of CSIR-SERC, wherein they were briefed on the state-of-the-art experimental facilities.



Swasth Nari, Sashakt Parivar Abhiyaan - Health Screening Camp for Women was organized at the CSIR campus on 18 December 2025. The Swasth Nari, Sashakt Parivar Abhiyaan is a nationwide health initiative inaugurated by the Hon'ble Prime Minister of India. It is focused on improving the health and nutrition of women and children across India.



Invited talks/lectures

- Dr. T. Hemalatha, Principal Scientist, delivered an invited lecture on **Special Concretes** at the School of Architecture and Planning, Anna University, Chennai on 13 October 2025
- Dr. N. Anandavalli, Director, CSIR-SERC, delivered a keynote address on **Laced Composite System for Enhanced Blast Resistance** in the conference IMPLAST, organized by CSIR-IIT, Roorkee through MS-Team, on 15 October 2025
- Dr. T. Hemalatha, Principal Scientist, delivered a guest lecture on **Research at CSIR-SERC** in the Project Expo at Vishnu Institute of Technology, Bhimavaram, on 24 October 2025
- Dr. P. Harikrishna, Chief Scientist, delivered invited lectures **Background to IS 875 (Part 3) Design Wind Speed and Design Wind Pressure - Part 1, Background to IS 875 (Part 3) Design Wind Speed and Design Wind Pressure - Part 2, Bluff Body Aerodynamics & Wind Force Coefficients - Part 2, Background to Gust Factor Method in the Wind Load on Structures** in the Customised Training Programme for L&T Engineers, organised by L&T Engineering Academy, at L&T Campus, Chennai, during 6-7 October 2025
- Dr. M. Keerthana, Principal Scientist, delivered invited lectures on **Bluff Body Aerodynamics & Wind Force Coefficients - Part 1, Dynamic Wind Effects & Serviceability Criteria for Tall Buildings and Interference Factors** in the Customised Training Programme for L&T Engineers, organised by L&T Engineering Academy, at L&T Campus, Chennai, during 6-7 October 2025
- Dr. P. Harikrishna, Chief Scientist, delivered an invited lecture titled **Cross-wind Force Spectra for Rectangular Buildings - A Review on Codes & Literature and Way Forward** in 11th National Conference on Wind Engineering, organised by VNIT, Nagpur and ISWE, on 14 November 2025
- Dr. Smitha Gopinath, Senior Principal Scientist, delivered 32nd Shri Vijay Zaveri Memorial Lecture titled **Textile Reinforced Concrete: A Journey of Innovation in Materials and Process** in 39th Annual General Meeting of Indian Society for Advancement of Materials and Process Engineering (ISAMPE), organised by ISAMPE, Bengaluru, on 14 November 2025
- Dr. P. Kamatchi, Chief Scientist, delivered an invited lecture titled **Concepts of Earthquake Engineering and Seismic Testing** in Quality Month Celebrations at Quality Control Division, Nuclear Power Corporation of India, on 17 November 2025
- Dr. S. Parivallal, Advisor (Management), delivered an invited lecture titled **Challenges in Lowering of In-service Gas Pipeline** in No Dig India Show 2025, organized by Indian Society for Trenches Technology (IndSTT) & Construction Industry Development Council (Established by Planning Commission of India), at New Delhi during 28-29 November 2025
- Dr. P.S. Ambily, Senior Principal Scientist, delivered an invited lecture titled **3D Printing of Concrete Advancements and Future Trends** in Industrial training programme for faculty members of Civil Engineering from Government, Government-Aided and Self-Financing Colleges, organised by National Institute of Technical Teachers Training and Research (NITTR) at Chennai, on 02 December 2025
- Dr. (Ing). Saptarshi Sasmal, Chief Scientist, delivered an invited lecture on **There is Enough Room at the Bottom - Material Engineering for Desired Structural Performance** during the programme on Advances in Resilient Infrastructure & Sustainable Initiatives under Climate Change, organized by Indian Institute of Technology Indore in collaboration with KMITL, Thailand at IIT Indore, on 3 December, 2025
- Dr. N. Anandavalli, Director, CSIR-SERC, delivered an invited lecture in technical session 1: **Innovative and Emerging Technologies for Sustainable Development of Natural Resources in Asia and the Pacific** in the International Conference on Technologies for the Sustainable Use of Natural Resources at Financial University, Moscow, Russian Federation, during 3-4 December 2025
- Dr. (Ing). Saptarshi Sasmal, Chief Scientist, delivered the Prof. P L Bhatnagar Memorial lecture entitled **Diffusion and Dissipation of Ultrasonic Wave in Multi-Scale Materials - Evaluation of Microstructure Development and Stress-State** at the Indian Society of Theoretical and Applied Mechanics (ISTAM 2025) Congress at Bhopal, on 10 December 2025
- Dr. (Ing). Saptarshi Sasmal, Chief Scientist, delivered an invited lecture on **Fingerprint - An Interrogation Tool for Health Assessment of Structures using Nonlinear Ultrasonic Features** in the session Theme NDE for Civil Infrastructure/Concrete-I at NDE2025, organized by Indian Society for Non-destructive Testing, at Mumbai, on 12 December 2025

Honours/awards/recognitions/nominations/PhDs

- CSIR-SERC secured **First Position** in the category of Large Offices for the best performance in the progressive use of Official Language during the year 2024-2025 at TOLIC on 21 November 2025
- Dr. (Ing.) Saptarshi Sasmal, Chief Scientist, received the **ISAMPE Award** for his commendable contribution in the areas of Smart Materials & System Technology Development and research contribution in Nano-engineered Smart Cementitious Composites for Embedded Multi-Metric Sensing towards Developing the Real-Time Health Monitoring of Structures on 14 November 2025
- Dr. J. Prawin, Principal Scientist, received the **Promising Young Structural Engineer of the Year 2025 by IAStructE**, on 15 November 2025 at New Delhi
- Dr. K. Lakshmi, Senior Principal Scientist, was awarded the **Best Paper titled Modal Identification of a Bridge Using the Vibration Response of a Passing Vehicle Combining VMD and TKEO, Suchit Kumar Memorial Prize 2025**, in the field of Bridge Engineering in Journal of Institution of Engineers-Series A on 5 December 2025
- Dr. Mohit Verma, Principal Scientist, secured **First Prize in the paper presentation in Hindi at the All India Official Language Scientific Seminar**, held at National Institute of Ocean Technology, Chennai on 18 December 2025
- Dr. B.S. Sindu, Senior Principal Scientist, was selected as **Indian National Academy of Engineering (INAE-Young Associate 2025)** and formally inducted in the academy on 20 December 2025 during the INAE Annual Convention 2025 held at HAL Management Academy, Bengaluru

Patents filed

1. Dr. C. Bharathi Priya, Mohit Verma, Jonnalagadda Chintaiyah Sunil, P. Kamatchi - filed a Patent on **Adaptive Mass Damper using Magneto Rheological Elastomer (MRE) for Dynamic Vibration Reduction (AdMiRE)** in India
2. Dr. A. Cinitha, B. Arun Sundaram, G. Ramesh - filed a Patent on **A Horizontal - Vertical Multi-Zone Furnace System for Standard and Custom Fire Testing** in India

Technologies developed during 2025

1. HyThermSlim: Thermo-mechanical hybrid simulation platform for structural testing
2. Fly ash and limestone calcined clay-based mixtures for concrete 3D printing
3. Floating platform for hybrid offshore horizontal axis wind turbine (HAWT) and solar farm
4. Floating offshore hybrid energy platform

Paper publications

- SCI Journals - 8
- Reputed Indian Journals - 4