



7TH MINDTCE
7TH MALAYSIA INTERNATIONAL NDT CONFERENCE AND EXHIBITION

| 20 & 21 AUGUST 2024

| THE GRAND LAGOON BALLROOM
SUNWAY RESORT HOTEL, MALAYSIA

“Breaking Barriers:
A Journey into Next-Gen
NDT Solutions”

PROGRAMME BOOK

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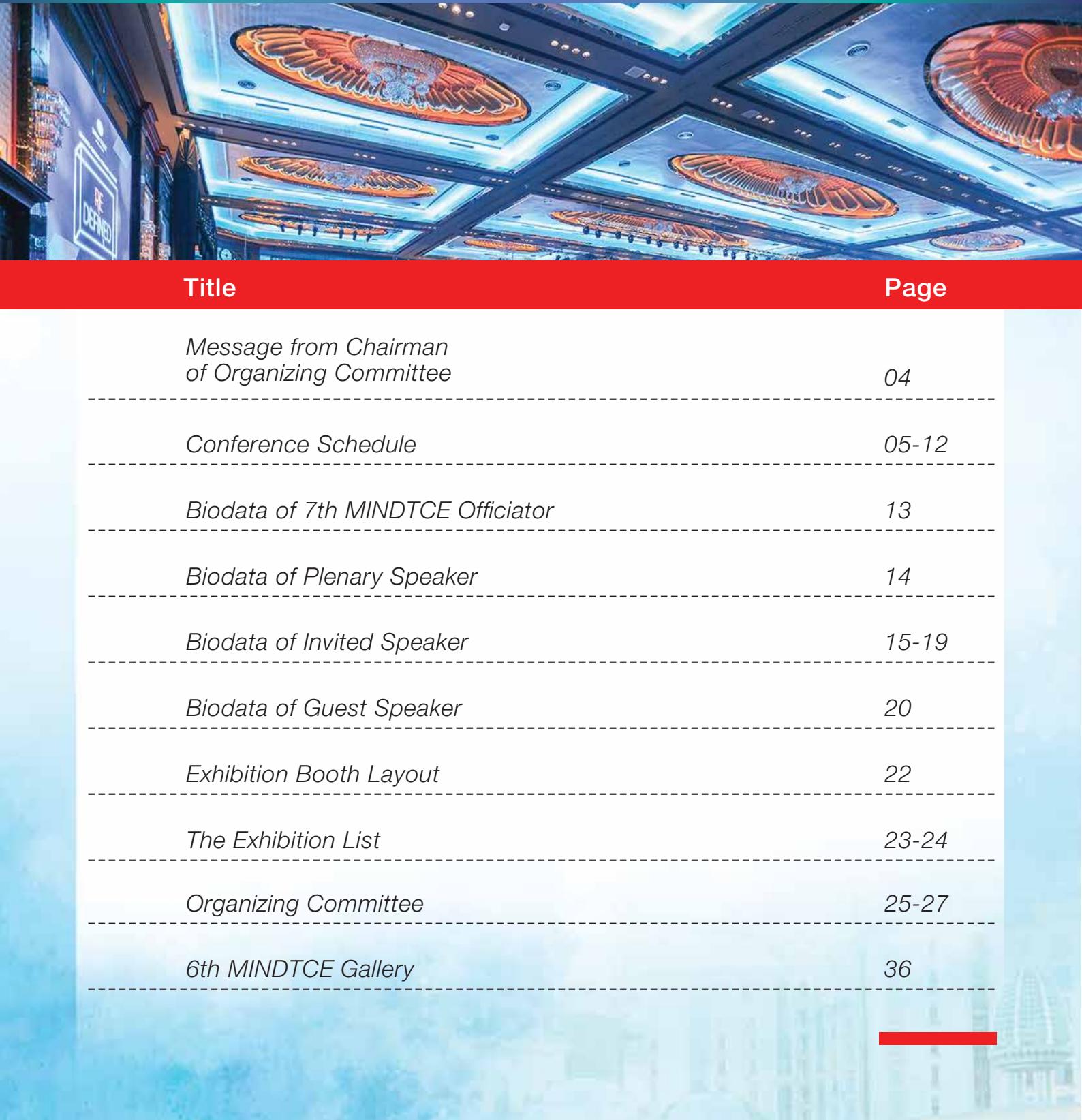


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MALAYSIA NDT CERTIFICATION BODY**

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CLASSES



STEP 4
GAINING
INDUSTRIAL
EXPERIENCE



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PASS A VISION
TEST



STEP 3
PASS THE THEORY
AND PRACTICAL
EXAMS



STEP 5
CERTIFICATION

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Federal Government Administrative, 62530 Putrajaya





MESSAGE FROM THE CHAIRMAN OF THE 7TH MINDTCE ORGANIZING COMMITTEE

Dear friends,

Malaysian Society for NDT (MSNT) has been established since 1989 to act as an umbrella to various organizations and individual who want to achieve one common goal, that is to optimize the benefit of NDT technology to the nation. Few years after its establishment, the Society began to feel that a series of national conference should be organized to provide an opportunity for all members to meet, to share experience, to present findings, to display the latest equipment and facilities available in the market. This is how the idea of having a series of national NDT conference came about. The conference bear various names in the past and then changed to Malaysia International NDT Conference and Exhibition (MINDTCE). The conference that we organize today, the 7th MINDTCE is the continuation of several conferences that have been organized in past years.

Organizing event of this kind requires a lot of effort and hard-work of many individuals and organizations. Large amount of time and funds are sacrificed to ensure that the event organized attained a level of standard acceptable by NDT professionals from all over the world. Program that includes pre-conference event, technical paper presentation, exhibitions and awards presentation has to be tediously planned to ensure that in all, the conference achieves its final objective and participants experiences some unforgettable memory both technically and socially. In this respect I witnessed how a number of individuals from government and nongovernment organizations under various subcommittees for the conference, namely Technical Committee, Promotional Committee, Exhibition Committee, Venue Management Committee, Secretariat Committee, have worked extremely hard regardless of time of the day since the last two years. Congratulation to all these committee members who made this event successful.

Members of the organizing committee admit that nothing in this world is ideal without shortcomings. However, I assure you that all individuals involved in the organization of this event have displayed their best effort to satisfy the wish of all participants. We hope that this conference will benefit all participants in the sense that new knowledge and experience will be acquired, new business linkages will be fostered and new cooperations will be established, new technologies to solve specific industrial problems will be identified and many other possible outcomes. We thank members of the various sub-committee of the conference, sponsors, exhibitors, paper presenters and many other individuals who have contributed either directly or indirectly for the success of this conference. Thanks a lot.

Dr. Abd. Nassir Ibrahim
Chairman of the 7th MINDTCE Organizing Committee



CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
DAY 1 : 20TH AUGUST 2024			
08.00 – 08.40	REGISTRATION		
08.40 – 08.45	SAFETY VIDEO		
08.45 – 08.50	WELCOMING REMARKS Dr. Abd. Nassir Ibrahim <i>Chairman of 7th MINDTCE Organizing Committee</i>		
08.50 – 08.55	REMARKS FROM ICNDT Dr. Sajeesh Kumar Babu <i>Chairman of the International Committee for NDT (ICNDT)</i>		
08.55 – 09.00	REMARKS FROM APFNDT Dr. Takamasa Ogata <i>President of Asia Pacific Federation for Non Destructive Testing (APFNDT)</i>		
09.00 – 09.30	OPENING REMARKS AND OFFICIATION Tan Sri Dr. Ir. Ahmad Tajuddin Ali, FASc. <i>Chairman of Malakoff Corporation Berhad</i>		
09.30 – 10.15	PLENARY SPEAKER Dr. Takamasa Ogata <i>President of Asia Pacific Federation for Non Destructive Testing (APFNDT)</i> Future Activities of APFNDT & 70 years of the Japanese Society for Non-Destructive Inspection (JSNDI)		
10.15 - 10.30	APFNDT GRATITUDE AWARD PRESENTATION		
10.30 – 11.00	GROUP PHOTOGRAPHY SESSION & COFFEE BREAK AT EXHIBITION HALL		



CONFERENCE SCHEDULE

		ROOM 1 - LAGOON 1	ROOM 2 - ARENA 4
1st SESSION		CHAIRPERSON: MR SHAHARUDIN KAMBARI	CHAIRPERSON: DR. AB RAZAK HAMZAH
11.00 – 11.30		INVITED SPEAKER 1 : Wan Abdullah Wan Hamat <i>Custodian (Inspection Engineering), Petroliam Nasional Berhad (PETRONAS)</i> NDT and Business Sustainability: Adapting to the Future Market	
11.30 – 11.50		PAPER 1A : Ahmad Naji Mahmood Zuhdi Unlocking Cost Savings and Safety with Drone-Based NDT Inspections in PETRONAS	PAPER 1B : Sapizah binti Rahim, Syaza Adani Ahmad Shahrul Aimee, Siti Nur Najihah Meor Kamarulzaman, Khairul Anuar Mohd Salleh, Arshad Yassin, Mohd Junaidi Jaapar Development of X-Ray Exposure Chart Phoporus-Based Imaging Plate for Steel Material
11.50 – 12.10		PAPER 2A : Siti Haslina Mohd Ramli, Norzaila Noordin, Hambali Chik, Roziman Yahya, Khairul Azni Abd Hamid, Dr. M Nor Syafik Yahya The Quest for Inspection Methods of Buried Non-Metallic Pipes: A Petronas Perspective	PAPER 2B : Mikhail Berdnikov DR Systems: Innovative Technologies in Industrial Radiography
12.10 – 12.30		PAPER 3A : Ts. Hashim B Othman, Juliana bt A Kadir, Ir. Ts. Hambali B Chik, Nisa Athirah Bt Ali A Novel Digital Risk-Based Integrity Management System for Lifting Equipment	PAPER 3B : Halim Abdul Rahman Control and Regulation of Industrial Radiography Activities in Malaysia
12.30 – 14.00		LUNCH BREAK AT SUNSET TERRACE LEVEL 1	



CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
2nd SESSION	CHAIRPERSON: MR. SHUHAILY YUSOFF	CHAIRPERSON: MR. PAUL GROSSER	
14.00 – 14.30	INVITED SPEAKER 2 : Dr. Sajeesh Kumar Babu <i>Chairman, International Committee for NDT (ICNDT)</i> Improving Reliability of Inspection in the Oil & Gas Industry for Storage Infrastructure : A NDE 4.0 Approach		
14.30 – 14.50	PAPER 4A Noor Hisyam Muhamad Integrating LDAR and Quantitative VOC Measurement for Enhanced Risk Based Maintenance	PAPER 4B Denis Kiesel The digital X-Ray inspection challenge and how we select technology	
14.50 – 15.10	PAPER 5A Lukman Sani, Ir. M Zaid Kamardin, Ts. Hashim Othman Delivering Operational Excellence with Enhanced Internal Visual Inspection (EIVI) Schemes for Pressurized Machinery	PAPER 5B Jan Bressendorff Trends and new applications – Portable X-ray	
15.10 – 15.30	PAPER 6A Mohd Zaini Mohd Zakaria, M Afiq B Mansor, Noraina Suyanti Bt M Aris, Noor Hisyam B Muhamad, Hazeem B Mahayadin, Wan Abdullah B Wan Hamat Advancing Tank Integrity Assessment: Validation of Robotic Inspection Against Traditional NDE Methods Assessment	PAPER 6B Nick D'Ademo Tangential and Double Wall Radiographic Pipe Inspection	
15.30 – 16.00	DRONE DEMONSTRATION AND COFFEE BREAK AT EXHIBITION HALL		

CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
3rd SESSION		CHAIRPERSON: DR. TAKAMASA OGATA	CHAIRPERSON: MR. M. S. VETRI
16.00 - 16.30		INVITED SPEAKER 3 : Prof. Dr. Krishnan Balasubramanian <i>President, Indian Society for NDT (ISNT)</i> AVASA: A new paradigm in PAUT	
16.30 – 16.50		PAPER 7A : Ir Mursyidi Mohammad Atmospheric Storage Tank In-service Robotic Inspection: API 653 Compliance and Avoiding Tank Shutdown	PAPER 7B : Mohd Zaini Mohd Zakaria, M Afiq B Mansor, Norzaila Bt. Nordin, M Baki B Mansor, Wan Abdullah B. Wan Hamat Artificial Intelligence (AI) for Smart Automated Radiographic Testing (RT) Welding Anomaly Evaluation and Image Fingerprint Analysis
16.50 – 17.10		PAPER 8A : Firdaus Idin, Bon Jon Koo OpenVision Method For Real Time CUI Inspection	PAPER 8B : Noorhazleena Azaman, Khairul Anuar Mohd Salleh, Ahmad Naim Ahmad Nazri, Muhammad Irfan Bin Khairuanuar Impact of Scanning Time Delay on Radiographic Image Quality in Computed Radiography for Non-Destructive Testing



CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
4th SESSION		CHAIRPERSON: DR. KHAZALI HJ MOHD ZIN	CHAIRPERSON: DR. SAJEESH KUMAR BABU
09.00 – 09.30		INVITED SPEAKER 4 : Mohd Alamin Pardi <i>Executive Director, Epic Aero Sdn. Bhd.</i> NDT in Aerospace Industry in Malaysia -Challenges & Opportunities	
09.30 – 09.50		PAPER 9A : Takahiro Saitoh, Sohichi Hirose Deep Learning for Laser Ultrasonic Wave Propagation Images and an Attempt to Detect a Defect in Concrete Materials	PAPER 9B : Mej. Ir. Ts. Dr. Arvinthan Venugopal Enhancing Structural Longevity of Aging Military Aircraft Through Non-Destructive Testing Inspections
09.50 – 10.10		PAPER 10A : Jeffry Jamil, Eliza M. Yusup, Nurul Auni Afrina Mohd Afandi Optimising Low-Frequency Phased Array Ultrasonic Testing (PAUT) Techniques for Characterisation of Defects in Glass Fiber Reinforced Polymer (GFRP)	PAPER 10B : Siti Madiha Muhammad Amir, Abdul Muhaimin Abdul Khalid, Mohd Dzul Aiman Aslan Enhancing Structural Longevity of Aging Military Aircraft Through Non-Destructive Testing Inspections
10.10 – 10.30		PAPER 11A : Simon Alain Solving 2d Corrosion Mapping Ultrasonic Inspection Challenges	PAPER 11B : Charles Tremblay, Duncan Murray High-Temperature Weld Inspection using ACFM® for Improved Plant Integrity and Safety
10.30 – 11.00		DRONE DEMONSTRATION AND COFFEE BREAK AT EXHIBITION HALL	

CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
5th SESSION	CHAIRPERSON: PROF. DR. KRISHNAN BALASUBRAMANIAN	CHAIRPERSON: MRS. SALBIAH HUSSEIN	
11.00 – 11.30	INVITED SPEAKER 5 : Paul Lang, <i>Chief Global Strategy Officer, American Society for NDT (ASNT)</i> Prakash Gokulanandam <i>American Society for NDT (ASNT) India</i> ASNT Certification and Awareness of SNT-TC-1A		
11.30 – 11.50	PAPER 12A Emilie Peloquin Building TFM Procedures For ERW Hook Crack, Girth Weld, HTHA And Other Challenging Inspection	PAPER 12B Sujit Chakravarty, Khairul Anwar Bharum NDT 4.0 Technology Transformation, with the Practice to Research of NDT in Malaysia. Detection of Strength and Weakness in Context of Present Scenario	
11.50 – 12.10	PAPER 13A Rovic Arceno Jr, Afiq AzniAhmad Zainuddin Matrix Array Ultrasonic Testing (MAUT)	PAPER 13B Muhammad Aslam Bin Abdul Rashid Enhancing Calibration Activity: Importance of Traceability in ISO/IEC 17025:2017 and Non-ISO Laboratories	
12.10 – 12.30	PAPER 14A Dr Chua Chien An, Andrew Lee Zhi Jie, Tomasz Pialucha Optimized Detection And Sizing Of Pipeline Corrosion At Supports Using Guided Wave Technology	PAPER 14B Alia Karian, Abdullah Fahmi, Tawfiq Mohamed Application Of Acoustic Emission Testing And Acoustic Pulsed Reflectometry Technique By Arise Star Sdn Bhd	
12.30 - 12.50	PAPER 15A Duncan Murray, Paul Jackson The Use Of Segmented Magneto-strictive Tools For Medium Range Ultrasonic Inspection Of Pipelines	PAPER 15B Marco M. Sisto, David Veilleux, Duncan Murray Advanced Tubing Inspection through Machine Learning in Non-Destructive Testing	
12.30 – 14.00	LUNCH BREAK AT SUNSET TERRACE LEVEL 1		

CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
6th SESSION		CHAIRPERSON: DR. TAMIL MOLI LOGANATHAN	CHAIRPERSON: MR. MOHD ALAMIN PARDI
14.00 – 14.30		INVITED SPEAKER 6 : Paul Grosser <i>Director, Level 3 NDT Pty. Ltd.</i> Automated Phased Array Ultrasonic Inspection System for Rail Wheel Sets	
14.30 – 14.50		PAPER 16A Choo Wei Lee, M Sazli B Ismail, Harith Fahmi B Mazlan, Wan Abdullah B Wan Hamat, M Afiq B Mansor, M Zaparel B Awang Roadmap Toward HDPE Pipe Joint Integrity Assurance Via Advanced NDT Solutions	PAPER 16B Joerg Ihrig The Revolution In Quality Control
14.50 – 15.10		PAPER 17A Cynthia Zuo Different application of ultrasonic C-Scan inspection	PAPER 17B Nurul A'in Binti Ahmad Latif, Ilham Mukriz Zainal Abidin Finite Element Method Simulation Of Time Domain Pulsed Eddy Current Technique On Ferromagnetic Plates
15.10 – 15.30		PAPER 18A Ken Low, Anand Subramanian Advancing NDE 4.0: The Innovation of Portable Ultrasonic Flaw Detector	PAPER 18B Egor Dyskin NDT for Steel Wire Rope: Applications and Standards
15.35 – 16.05		DRONE DEMONSTRATION AND COFFEE BREAK AT EXHIBITION HALL	



CONFERENCE SCHEDULE

		ROOM 1 – LAGOON 1	ROOM 2 - ARENA 4
7th SESSION	CHAIRPERSON: MR. WAN ABDULLAH WAN HAMAT	CHAIRPERSON: DR. SITI MADIHA MUHAMMAD AMIR	
16.00 - 16.20	PAPER 19A Alaina Qi Software And Hardware Advantages Of Ultrasonic C-scan Inspection System	PAPER 19B Stanley Leong Enhanced 3D Measurement of Orbital Welds in Confined Spaces using Advanced Image Processing and 3D Stitching	
16.20 – 16.40	PAPER 20A Afiq Azni bin Ahmad Zainuddin, Royce Wong, Jeffry Jamil Defect Detection Of Non-metallic Materials Using Matrix Array Ultrasonic Testing	PAPER 20B Muhammad Afiq B Mansor, Mohd Zaini B Mohd Zakaria, A Rahim B A Ghani, Wan Abdullah B Wan Hamat Enhanced 3D Measurement of Orbital Welds in Confined Spaces using Advanced Image Processing and 3D Stitching	
16.40 – 17.00	PAPER 21A Michael Monette, Paul Hillman, Guy Maes Total Focusing Method (TFM) and Phase Coherence Imaging (PCI) applied for weld inspection and HTHA		
17.00 - 17.10	CLOSING CEREMONY Dr. Ilham Mukriz Zainal Abidin President of Malaysian Society for NDT (MSNT)		



7th MINDTCE OFFICIATOR

Academician Tan Sri Datuk Dr. Ir. Ahmad Tajuddin Ali, FASc., FIEM

P.S.M, S.J.M.K., S.I.M.P, P.J.N, D.P.C.M, D.P.M.P, J.M.N, A.M.N
Ph.D (London), B.Sc (Eng.) Hons (London)

We are honored to introduce Academician **Tan Sri Datuk Dr. Ir. Ahmad Tajuddin Ali**, who will officiate the 7th Malaysia International NDT Conference and Exhibition (MINDTCE). Tan Sri Dr. Tajuddin currently serves as the Chairman of the Board of Malakoff Corporation Berhad and is actively involved in various capacities with several other companies and statutory bodies. He holds Chairmanships at ITMAX System Berhad, Plytec Holding Berhad, Linde Malaysia Holdings Berhad, and Malaysian Shoaiba Consortium Sdn Bhd. Additionally, he is the Joint Chairman of the Malaysian Industry-Government Group for High Technology (MIGHT), a Government-Industry think-tank promoting high-technology investments in Malaysia.

Tan Sri Dr. Tajuddin is also a Northern Corridor Implementation Authority (NCIA) member, chaired by the Prime Minister of Malaysia, and an Advisory Council member of the Federation of Malaysian Manufacturers (FMM). His dedication to education and industry is reflected in his roles as a Board of Trustees member for the Tropical Science Foundation and as the Chairman of the Board of Governors of the Malay College Kuala Kangsar. Moreover, he is the Pro-Chancellor of Universiti Tenaga Nasional (UNITEN).

Previously, Tan Sri Dr. Tajuddin held notable positions such as Chairman of SIRIM Berhad, Director-General of Standards and Industrial Research Institute of Malaysia (SIRIM), Chairman and Chief Executive of Tenaga Nasional Berhad, Chairman of the Energy Commission Malaysia, and various leadership roles in companies like the UEM Group Berhad and the PLUS Expressways International Berhad. His extensive experience also includes significant contributions to organizations such as Sime Darby Berhad and the Academy of Sciences Malaysia.

Tan Sri Dr. Tajuddin graduated with First Class Honours in Mechanical Engineering from King's College, University of London, in 1973 and earned his doctorate in Nuclear Engineering from Queen Mary College, University of London, in 1977. He pursued post-doctoral work in nuclear engineering at Oregon State University and Pennsylvania State University. He is a Registered Professional Engineer with the Board of Engineers (P.Eng), a Fellow of the Institution of Engineers Malaysia (FIEM), and holds fellowships in various esteemed engineering and scientific organizations.

Throughout his illustrious career, Tan Sri Dr. Tajuddin has received numerous accolades, including honorary degrees from several universities and prestigious awards such as the Special Award by Japan External Trade Organisation (JETRO) and the "The Order of The Rising Sun, Gold Rays with Neck Ribbon" by the Government of Japan. In 2022, he was honored with the BEM Malaysia Most Prominent Engineering Leader Award from the Board of Engineers Malaysia.

Tan Sri Dr. Tajuddin's remarkable contributions to engineering, technology, and education and his exemplary leadership make him a distinguished and inspiring figure. We are privileged to have him officiate the 7th MINDTCE, and we look forward to the invaluable insights and guidance he will bring to the event.



PLENARY SPEAKER
OF THE 7TH MALAYSIA INTERNATIONAL NDT
CONFERENCE AND EXHIBITION

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Introducing the 7th Malaysia International NDT Conference and Exhibition (7th MINDTCE) Plenary Speaker, **Dr. Takamasa Ogata**. Dr. Ogata is a prominent figure in the NDT community, bringing decades of experience and expertise to the field. He currently serves as the Technical Advisor at Kawasaki Heavy Industries, contributing to pioneering advancements in NDT. Additionally, Dr. Ogata is the President of The New Industry Research Organization, driving innovation and collaboration across various industries.

Dr. Ogata's influence extends globally through his past roles as President and Director of International Relations at the Japanese Society for Non-Destructive Inspection (JSNDI). As the President of The Asia-Pacific Federation for Non-Destructive Testing (APFNDT), Dr. Ogata is dedicated to elevating NDT practices in the Asia-Pacific region, envisioning NDT technology as a cornerstone for safe and prosperous societies. His leadership aims to address disparities in technology, certification systems, and standardization and enhance communication and collaboration among APFNDT member societies.

Dr. Ogata's presentation at the 7th MINDTCE will cover "Future Activities of APFNDT and 70 Years of JSNDI," offering invaluable insights into the future of NDT. His vision includes strengthening the secretariats of APFNDT and positioning Asia-Pacific countries at the forefront of industrial NDT on a global scale. Join us at the conference to learn from Dr. Ogata's wealth of knowledge and his commitment to advancing NDT technology worldwide. This is an opportunity to gain insights from a leader shaping NDT's future, ensuring it remains a vital component of safe and resilient societies.



ABSTRACT OF PRESENTATION

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The APFNDT decided to strengthen the secretariat functions of national societies as a key strategy for its activities at its board meeting last year. The goal is to accelerate the development of national societies' activities by strengthening the secretariat functions through the exchange of information and opinions among their respective national societies.

As a model case for this activity, JSNDI, which serves as the secretariat of APFNDT, and MSNT, which has been developing remarkably in recent years, have started to exchange information and exchange their secretariats with each other. In this talk, the JSNDI will report on its activities in academia, education, certification, publication, standardisation and international cooperation, based on its own history of more than 70 years. It is hoped that some of these experiences and challenges will serve as a reference for the development of MSNT and other societies.





INVITED SPEAKER 1

OF THE 7TH MALAYSIA INTERNATIONAL NDT
CONFERENCE AND EXHIBITION

Mr. Wan Abdullah Wan Hamat is a distinguished figure in the field of NDT and currently works with PETROLIAM NASIONAL BHD (PETRONAS) as a Custodian in Inspection Engineering.

His extensive expertise spans NDT, welding technology, corrosion engineering, fitness for service, and static equipment inspection, including crane inspection and maintenance. With over 30 years of experience in the oil and gas sector, Mr. Wan Abdullah has played a pivotal role in developing new facilities and managing aging assets for PETRONAS, domestically and internationally.

Mr. Wan Abdullah is highly active in workforce development within PETRONAS, providing classroom training, organizing hands-on exposure for engineers, developing step-by-step technical procedures, and conducting technical capability assessments. He also holds the position of ISO 17020 assessor and serves as a National resource person for NDT under Malaysia's Ministry of Human Resources. From 2020 to 2022, he was the Vice President of the Malaysian Society for NDT (MSNT) and has been reappointed for the term 2024-2026.

In addition to his roles at PETRONAS, Mr. Wan Abdullah is an adjunct lecturer at several prestigious institutions, including the National University of Malaysia, Universiti Teknologi PETRONAS (UTP), Universiti Teknologi Mara (UiTM), Universiti Teknikal Malaysia Melaka (UTeM), and University Malaysia Terengganu (UMT). His academic credentials include an Honors degree in Nuclear Physics from the National University of Malaysia (1989-1993).

Mr. Wan Abdullah holds numerous professional certifications, including ASNT NDT Level III in Ultrasonic Testing, API 510, API 570, API 653, CSWIP 3.1, and ASNT Level II in various NDT methods (MT, PT, RT, and UT). He is also a certified Radiation Protection Officer (RPO) and has authored and presented multiple technical papers internationally.

Mr. Wan Abdullah has advised, applied, and provided implementation support for advanced operational technologies throughout his career. He leads the integration and implementation of specialized knowledge in key and emerging technologies, screens and implements innovative solutions, and mentors potential talents within his skill group. His expertise extends to performing HSE and integrity audits for new and aging assets, reviewing new technical standards, and leading P-RBI implementation.

Mr. Wan Abdullah is a member of several prestigious organizations, including the American Society of Nondestructive Testing (ASNT) and the Asia Pacific Committee of NDT (APCNDT). He is also a voting member of ISO TC#135 and an ISO 17020-certified Auditor. His contributions to the field of NDT are globally recognized, with published papers on flexible pipe management and strain design of pipelines, as well as over 15 international presentations.



INVITED SPEAKER 2

OF THE 7TH MALAYSIA INTERNATIONAL NDT CONFERENCE AND EXHIBITION

Dr. Sajeesh Kumar Babu currently serves as the Chair of the International Committee for Non-destructive Testing and the President of the Non-Destructive Testing Society (Singapore) (NDTSS). He is also the CEO of ANSA Holdings and the Quality Director at Rotary. His leadership and contributions have significantly advanced the field of NDT, earning him widespread recognition and respect.

In addition to his impressive professional roles, Dr. Babu holds an Engineering Doctorate from City University Hong Kong. He is a Chartered Engineer in the UK and Singapore, a Registered Professional Engineer in Hong Kong, and an NDT Level 3 certified professional from ASNT, PCN, and SGNDT. His academic and professional credentials underscore his deep knowledge and commitment to excellence in the field of NDT.



INVITED SPEAKER 3

OF THE 7TH MALAYSIA INTERNATIONAL NDT CONFERENCE AND EXHIBITION

Prof. Dr. Krishnan Balasubramanian has been involved in the field of Non-destructive evaluation for more than 33 years with applications in the fields of maintenance, quality assurance, manufacturing and design. He has over 480 technical publications (including 260 refereed journal papers), 30 patents filings and has directed 25 PHD student dissertations and 49 MSc student theses.

In recognition for his outstanding contributions to research in the field of Nondestructive Evaluation, he was conferred with the ROY SHARPE PRIZE by the British Institute for NDT for the year 2012. He was also awarded the ISTEM Entrepreneurial Faculty Member Award for his entrepreneurial activities by Auburn University, USA in 2011 and the NATIONAL NDT AWARD 2010 by the Indian Society for NDT. He also was conferred the DRDO Academy Excellence Award for 2015. In 2018, he was bestowed with the prestigious ABDUL KALAM National Technology Innovation Fellowship by the Indian National Academy of Engineers and the Life Time Achievement Award by the Indian Institute of Technology Madras.

He has been instrumental in the incubation of several startups including Dhvani Research, Plays Technologies, Detect Technologies, Maximl Labs, Trotix Robotics, HyperVerge, and Solinas Integrity. He currently serves as the Editor-in-Chief of the Journal for Nondestructive Evaluation (ISNT) and as the South-east Asia Editor for the Journal of Nondestructive Testing and Evaluation (Taylor and Francis). He also serves as the Associate Editor of Ultrasonics (Elsevier) and Subject Editor for NDT&E International (Elsevier) and in the editorial board of the Journal of Structural Longevity (Techscience). He also is a board member of the World Federation of NDE Centers and the QNDE Scientific Advisor Committee.

He is a Life Fellow of the Academia NDT International, Life Fellow of the Indian Society of Nondestructive Testing (ISNT) and a Fellow of the Indian National Academy of Engineers.



INVITED SPEAKER 4

OF THE 7TH MALAYSIA INTERNATIONAL NDT
CONFERENCE AND EXHIBITION

Mr. Mohd Alamin Pardi is currently the Executive Director and Responsible NDT Level 3 at Epic Aero, as well as the Director and Consultant at EAG Consultancy. His expertise in NDT encompasses multiple methods, including PT, MT, ET, UT, RT, and TT. He is certified ASNT Level III, PCN Level III, and EN4179/NAS410 Level III across various NDT methods. Additionally, he is a certified Radiation Protection Officer (RPO) and a qualified QMS Auditor/Lead Auditor.

Mr. Alamin's academic credentials include a Master's in Business Administration (MBA) from Universiti Teknologi MARA (UiTM) and dual Bachelor's degrees in Aerospace Engineering and Aeronautics from St. Louis University, both achieved with Magna Cum Laude honors. He also holds an FAA A & P Licence from St. Louis University.

Throughout his career, Mr. Alamin has held key positions in notable organizations. As the Head of NDT at CTRM Aero Composites Sdn Bhd, Batu Berendam, Melaka and Malaysia Airlines, he managed NDT departments, developed staff skills, and ensured compliance with regulatory standards. His roles involved significant responsibilities such as developing NDT procedures, conducting audits, and providing customer technical support.

At Epic Aero Sdn Bhd, Mr. Alamin oversees the entire business operation, ensuring staff and equipment are adequately prepared to meet customer needs. He prepares annual business plans and budgets, performs technical evaluations for new NDT machines, and liaises with authorities on technical and airworthiness requirements. His leadership and technical expertise have been instrumental in advancing the capabilities and operations of the organizations he has served.

At EAG Consultancy, Mr. Alamin provides NDT consultancy, conducts training and examinations, and offers technical advice on new NDT plant development and installation. He is dedicated to mentoring NDT personnel, conducting competency assessments, and supporting customers with on-site technical expertise.



INVITED SPEAKER 5

OF THE 7TH MALAYSIA INTERNATIONAL NDT
CONFERENCE AND EXHIBITION

Mr. Paul Lang is the Chief Global Strategy Officer for the American Society for Nondestructive Testing (ASNT) and Executive Director for ASNT Certification Services LLC (ASNT CS). He oversees all ASNT certification, accreditation, and standards activities with a shared vision of strengthening and expanding ASNT's global presence through its portfolio of products and services. Lang served 21 years in the US Navy, retiring as a Chief Warrant Officer. He has led engineering departments, intermediate repair facilities, and served as a local government inspector performing repair and NDT oversight for the US Navy.

He also led training and audit teams that provided training and rigorous evaluation of the Navy's engineering operations and quality assurance programs. After retiring from the Navy, Lang joined an internationally renowned insurance and inspection company providing risk assessments on facilities of various industry sectors such as power generation and large manufacturing along with supervising a regional jurisdictional inspection force for in-service boiler and pressure equipment. He joined ASME in December 2013 as Director of Audit & Inspections and moved to lead the technical aspects of all ASME Conformity Assessment Certification programs in 2016, recently overseeing all engineering operations and services activities. Paul joined ASNT in 2022.



INVITED SPEAKER 5

OF THE 7TH MALAYSIA INTERNATIONAL NDT
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Mr. Prakash Gokulanandam is the Director and General Manager of The American Society for Nondestructive Testing India. He was one of the people who was instrumental in the formation of ASNT's Indian venture. He is a Mechanical Engineer with Master of Business Administration. He has 13 years of experience in the field of Nondestructive Testing. He holds ASNT, NAS 410, ISO 9712 NDT Level III in various methods. He is a Radiological Safety Officer certified & approved by BARC and AERB. He was the founding Secretary of the American Society for Nondestructive Testing India Section. Before joining ASNT India, Prakash heads an NDT service company in Chennai.



INVITED SPEAKER 6

OF THE 7TH MALAYSIA INTERNATIONAL NDT
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Mr. Paul Grosser who is a Chartered Engineer (CEng) accredited by the Engineering Council UK, holds a First-Class BSc Hons in Non-Destructive Testing. He is certified to ISO 9712 Level 3 in a comprehensive range of techniques, including Magnetic Particle, Liquid Penetrant, Eddy Current, Ultrasonics, Radiography, Phased Array, and Time-of-Flight Diffraction (TOFD) by the Australian Institute for Non-Destructive Testing (AINDT). Additionally, he holds a Pressure Vessel Inspector certification from AICIP.

With a career spanning over two decades, Mr. Grosser has been the Level 3 NDT Director since March 2022, providing consulting services and overseeing NATA Laboratory Technical Control. Previously, he held the role of Technical Director NDT at ATTAR from March 2003 to March 2022, where he was instrumental in training and assessing NDT professionals. He accumulated over seven years of experience in NDT consulting and management before this.

Mr. Grosser is also recognized for his approvals and memberships in the field, serving as an approved examiner for both the Australian Institute for Non-Destructive Testing and the British Institute for Non-Destructive Testing (PCN), as well as an approved NATA (ISO17025) assessor. He contributes actively as a current voting member of Standards Australia NDT Committee MT007 and has been a key NATA (ISO 17025) NDT Accreditation Advisory Committee member since 2013.

His leadership extends to international platforms, where he has served as the Technical Expert and Chairman of NDT Technical Committees for the International Atomic Energy Agency since 2009, representing Australia in NDT activities. He also served on the Board of Directors for the Asia Pacific Federation For NDT (APFNDT) from 2007 to 2023. He held various roles within the Australian Institute for Non-Destructive Testing, including President from 2016 to 2018 and Vice President from 2014 to 2016.



GUEST SPEAKER 1

OF THE 7TH MALAYSIA INTERNATIONAL NDT
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Mr. Ahmad Naji is a Staff Researcher at PETRONAS Research Sdn Bhd (PRSB), where he leads projects focused on robotic inspection. His expertise lies in developing and deploying robotic crawlers and drones for NDT. Mr. Naji is dedicated to promoting these cutting-edge technologies within PETRONAS, aiming to integrate them across PETRONAS assets. He firmly believes that robotic technology offers significant advantages in terms of safety, time efficiency, and cost-effectiveness compared to traditional NDT methods.

A former PETRONAS scholar, Mr. Ahmad Naji, holds a degree in Mechanical Engineering from Imperial College London. After graduating, he was seconded to Sauber PETRONAS Engineering in Switzerland and Ricardo Consulting Engineers in the UK, where he contributed to engine development projects. He spent the next 18 years in the automotive industry, gaining extensive experience. 2010 he left PETRONAS to advance his career in Australia and China before returning to PETRONAS in 2018. Since then, he has been integral to PETRONAS Research, driving innovation in robotic inspection technologies.



GUEST SPEAKER 2

OF THE 7TH MALAYSIA INTERNATIONAL NDT
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Mr. Halim Abdul Rahman is a Deputy Director at the Radiation Control and Supervision Division for the Jabatan Tenaga Atom (Atom Malaysia), Malaysia's atomic energy regulatory authority. He has been working with Atom Malaysia for almost 20 years. In his 20 years of experience, he has engaged in several Atom Malaysia divisions, such as the Technical Support Division, Assessment and Licensing Division, Radiation and Control Division, and the Atom Malaysia Branch Office.

His main responsibilities in Atom Malaysia were assessment and inspection tasks for all atomic energy activities in Malaysia, comprising irradiation facilities, industrial radiography, gauges, sales, research and education, particle accelerator, mineral processing, calibration, and analysis.

During his engagement in the Assessment and Licensing Division, he was involved in the assessment, licensing, and approval of various industrial radiography activities comprising the radiation safety assessment, radiation protection program, emergency plan, radiation security plan, and others whereby in Radiation Control and Supervision Division, he involved a lot in the planning and implementing the inspection activities to ensure its compliances towards the requirement of the Act and its subsidiary legislations for the protection of workers, public and the environment from radiation risk.

Due to his experience, Mr Halim was appointed as a member of the Examination and Certification of NDT Committee under the Department of Skill Development from 2021-2023, where the competencies and qualifications of NDT practitioners will be certified and recertified via this committee.

In terms of contribution, Mr. Halim is also involved in the development of the National Occupational Skill Standard (NOSS) for NDT (2022), which is the document that outlines the skills required by a skilled worker for the NDT field and job level and the path to achieving those skills.

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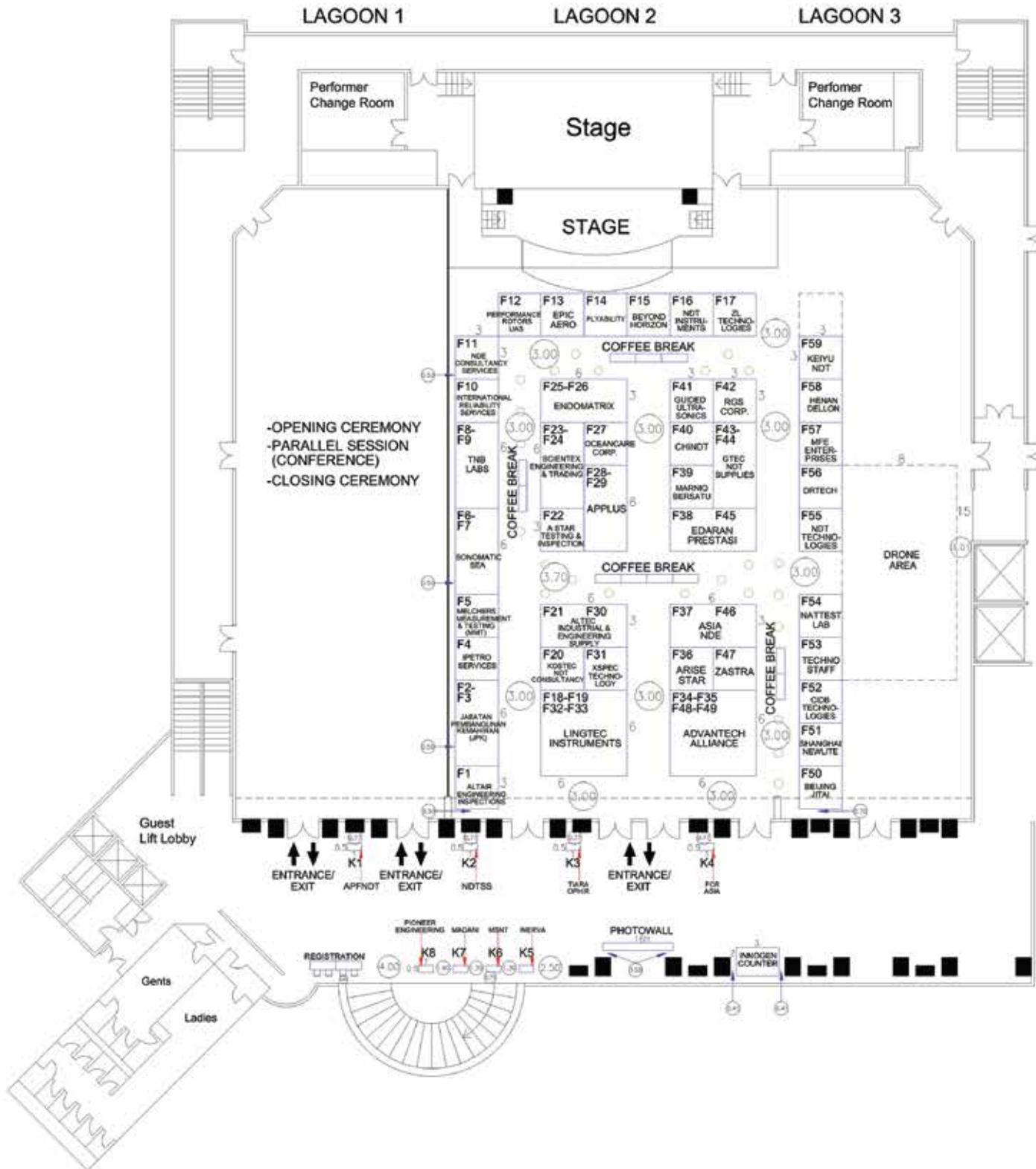
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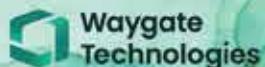


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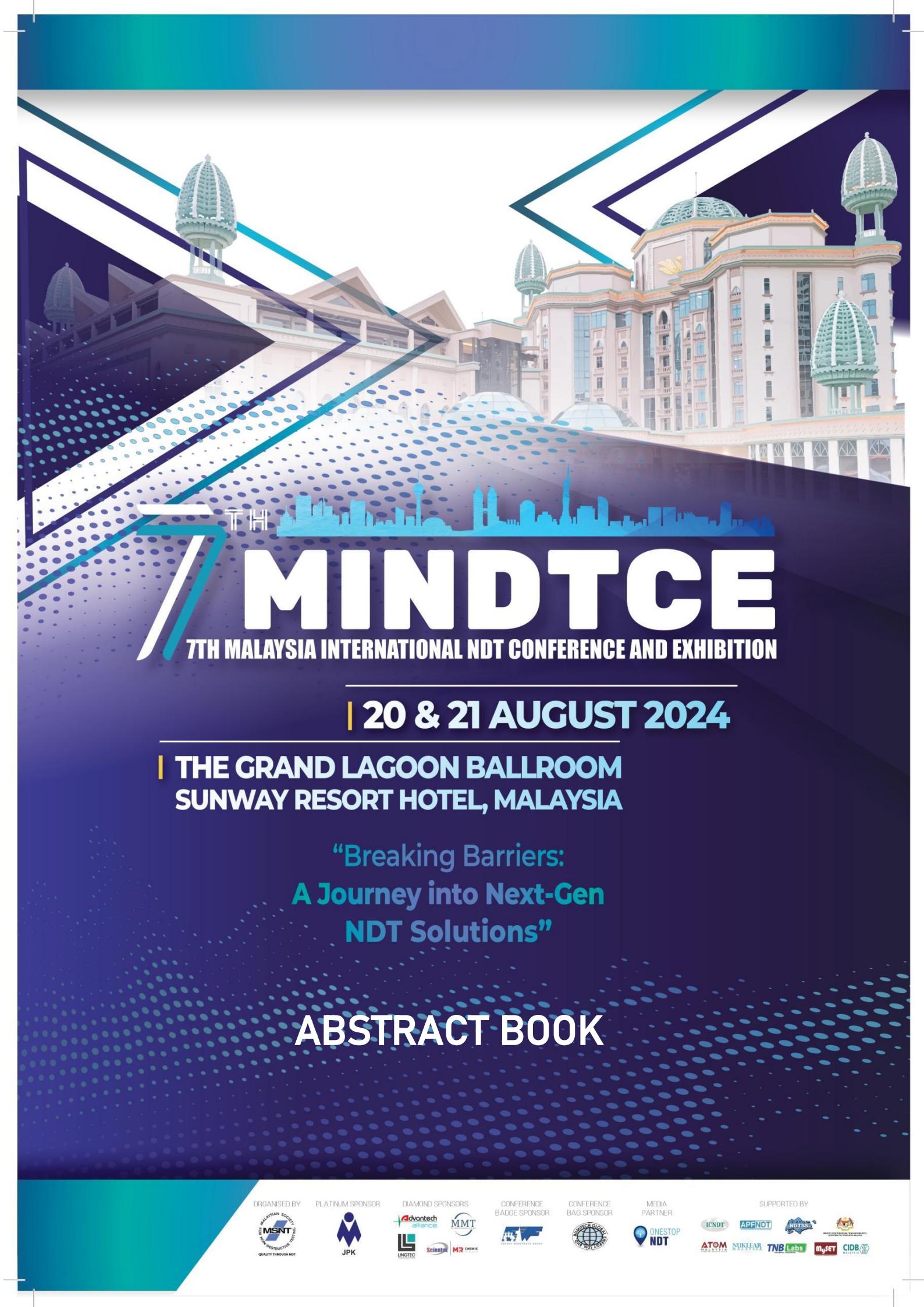




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PAPER 1A**UNLOCKING COST SAVINGS AND SAFETY WITH DRONE-BASED NDT INSPECTIONS IN PETRONAS**

Ahmad Naji Mahmood Zuhdi

Project Delivery & Technology,
PETRONAS Research Sdn. Bhd.

Abstract

Non-Destructive Testing (NDT) inspections of industrial assets often involve hazardous conditions, time-consuming processes, and significant costs. However, recent advancements in robotics have introduced a safer and more efficient solution in the form of NDT drones. These unmanned aerial systems offer NDT experts a unique perspective, enabling them to access remote or otherwise inaccessible areas without compromising safety. By integrating NDT probes onto drones, inspections can be conducted swiftly and accurately. The benefits include reduced operational costs and minimized safety risks. This paper outlines PETRONAS' initiatives in qualifying NDT drone technology and operationalizing its use.

PAPER 2A

THE QUEST FOR INSPECTION METHODS OF BURIED NON-METALLIC PIPES: A PETRONAS PERSPECTIVE

Siti Haslina Mohd Ramli¹, Norzaila Noordin¹, Hambali Chik¹, Roziman Yahya², Khairul Azni Abd Hamid³, Dr M Nor Syafik Yahya³

¹PETRONAS GTS

²PRPC

³PETRONAS GT&C

Abstract

There are various numbers of non-metallic pipes in PETRONAS OPUs including refineries, petrochemical and gas plants. Some of these pipes are buried, and not registered in PETRONAS RBI under Inspection Reference Plan and thus not under the radar of inspection reference plan. As the non-metallic pipes are often assumed as maintenance free, the integrity of the non-metallic pipes may sometimes come under spotlight. To provide integrity assurance, it is prudent to have a method to assess the condition of the pipes, without excavating or shutdown of operation. Operators have experienced high occurrences of underground non-metallic piping failures mainly attributed by several factors including related to geo-tech issues (soil movement). Current inspection method requires the piping system to be shutdown & extensive excavation activities. Visual & NDT inspection is conducted upon excavation of the underground piping line to assess the defects. Upon any findings, operation will then need to conduct the necessary maintenance on the defective areas. In fulfilling such expectations and in ensuring operational safety, the industry therefore requires regular monitoring and inspection of the non-metallic pipelines and piping. PETRONAS launched a crowdsourcing exercise with the aim to look for an effective and reliable non-intrusive inspection system that is capable to assess the integrity of non-metallic buried underground pipe (1.5-2m depth) without having to perform soil investigation, excavation and exposing the pipe prior to inspection. The proposed solutions were to meet the following requirements:

- Detect and/or monitor the condition of the buried non-metallic piping including GRP, HDPE, PVC, etc. without excavation.
- Perform inspection for a range starting from 2-16 inches (but not limited to) pipe diameter & at minimum of 1m depth.
- Perform online inspection without shutdown or isolation.
- Non-intrusive method is preferred.
- The proposed technology must be at minimum of TRL 5

Fifteen submissions were received from around the world including from UK, Australia and USA, and were evaluated according to acceptance criteria set by PETRONAS Subject Matter Experts. The submissions underwent three evaluation stages, and the shortlisted technologies were then weighed according to cost and case study evaluation.

This paper will share on the evaluation exercise and the outcome of the technology challenge search for the best inspection method for buried non-metallic pipes.

Keywords: Non-metallic, inspection, buried, evaluation

PAPER 3A**A NOVEL DIGITAL RISK-BASED INTEGRITY MANAGEMENT SYSTEM FOR LIFTING EQUIPMENT**

Ts. Hashim B Othman, Juliana Bt A Kadir, Ir. Ts. Hambali B Chik, Nisa Athirah Bt Ali

PETRONAS Group Technical Solutions

Abstract

SafeLif+ is a game changer novel solution developed by PETRONAS leveraging on the latest advancements in technology and digital solutions to address key industry challenges primarily focusing on enhancing the reliability and safety of lifting equipment (LE) by transitioning from time-based to risk-based equipment integrity management system. The initiative encompasses a systematic process of inspection, testing, and monitoring, grounded in a risk-based integrity assessment and review framework, complemented by visual tools for integrity inspection, testing, and assurance to ensure operational safety. By integrating SafeLif+, occupiers in Malaysia are enabled to employ a Risk-Based Inspection (RBI) strategy to maintain, monitor, and ensure the integrity of LE, paving the way for complete self-regulation of all DOSH-registered equipment types. This paper will outline the framework of this initiative, the concept of LE RBI assessment, the features of the digital solution, and the strategic deployment plan.

Keywords : lifting equipment, risk-based inspection, self-regulation

PAPER 4A**INTEGRATING LDAR AND QUANTITATIVE VOC MEASUREMENT FOR ENHANCED RISK BASED MAINTENANCE**

Noor Hisyam Muhamad

PETRONAS Penapisan (Terengganu) Sdn Bhd

Abstract

Leaks at the roof seal of external floating roof tanks (EFRTs) pose a significant fire risk, particularly in the presence of ignition sources such as lightning. While current Leak Detection and Repair (LDAR) methods using infrared camera are proficient in detection, they often lack effectiveness in prioritizing leaks for maintenance and rectification. In response, we have implemented a novel approach that combines LDAR with enhanced IR camera with quantitative Volatile Organic Compound (VOC) measurement tools capable of quantifying leak rates in kg/hour. This data is integrated into a risk-based assessment tool that considers other factors to determine the severity of the leak and subsequently assesses the overall risk of the tank. By leveraging risk ratings generated from this assessment, maintenance teams can strategically prioritize repairs and rectifications, thereby reducing the likelihood of tank fires. Furthermore, our strategy significantly curtails VOC emissions, minimizing product loss due to evaporation and supporting sustainability objectives by mitigating the greenhouse effect. Through empirical observation, we have observed a tangible reduction in both fire risk and VOC emissions, underscoring the effectiveness of our integrated approach in enhancing safety and environmental sustainability in tank terminals and refineries.

Keywords : IR Thermography with quantitative measurement tools

PAPER 5A**DELIVERING OPERATIONAL EXCELLENCE WITH ENHANCED INTERNAL VISUAL INSPECTION (EIVI)
SCHEMES FOR PRESSURIZED MACHINERY**

Lukman Sani, Ir. M Zaid Kamardin, Ts. Hashim Othman

PETRONAS Group Technical Solutions

Abstract

Historically, Periodic Inspection has involved Pressurized Machinery entry for internal visual inspection and testing (IVIT) by qualified Inspectors. The very nature of Direct Internal Visual Inspection and Testing (Direct IVIT) requires extensive plant outages and cleaning programs as well as safe working environment, which is time consuming, costly and may introduce safety concerns for the operators. This presents major challenges to meet regulatory requirements for intrusive internal inspection. Enhanced Internal Visual Inspection (EIVI) schemes are introduced to provide the users with the framework and recommended elements for robust inspection planning by enhancing internal visual inspection requirements to meet the statutory obligations through best effort demonstration and leveraging industry best practices. This paper offers an alternative approach to Direct IVIT to maximize the value for assets without jeopardizing risk of operation and production. Various EIVI schemes for Pressurized Machinery including Non-Intrusive Inspection (NII), Representative IVIT, Focused & Targeted IVIT and Remote IVIT are discussed. Furthermore, eligibility assessment of each scheme as well as scoping and planning, technical validation, and economical evaluation aspects are also developed to guide for a comprehensive decision-making process. Additionally, Enhanced Risk-based Data (ERD) based on industry best practice such as IOW monitoring, corrosion monitoring data, metal temperature monitoring, data from same or similar service are also discussed as an alternative to in lieu of thickness measurements data, for completing RBI assessment with high confidence. The outcome of the assessment is used to guide the development of the specific Scheme of Examination (SOE) for the applicable Pressurized Machinery to ensure that they can achieve similar level of risk reduction in a safer, efficient, and more economical way. Adoption of this new approach within PETRONAS OPU's in guiding future inspection and maintenance planning will be a potential game changer in risk reduction strategy for Pressurized Machinery

Keywords : NII, IVIT, Representative, Remote, Targeted, SOE, IOW

PAPER 6A**ADVANCING TANK INTEGRITY ASSESSMENT: VALIDATION OF ROBOTIC INSPECTION AGAINST TRADITIONAL NDE METHODS ASSESSMENT**

Mohd Zaini Mohd Zakaria, M Afiq B Mansor, Noraina Suyanti Bt M Aris, Noor Hisyam B Muhamad Hazeem B Mahayadin, Wan Abdullah B Wan Hamat

PETRONAS Group Technical Solutions

Abstract

Traditionally, assessing the integrity of storage tank bottom plate has required tanks to be shut down and taken out of service (OOS) for conventional Non-Destructive Examination (NDE) methods such as Ultrasonic Testing (UT) and Magnetic Flux Leakage (MFL). These inspection methods require a tank shut-down and confined space entry (CSE), which incurs operation downtime, loss of production opportunity, and cost for hydrocarbon-free environment for safe entry. Robotic tank floor inspection technology presents an advanced alternative, enabling the assessment of tank bottom integrity while the tank remains online and in service. This method is permitted by API 653 (Tank Inspection, Repair, Alteration, and Reconstruction) as a viable substitute for conventional NDE. During the tank bottom inspection, the robotic equipment utilizes Phase Array UT (PAUT) with 128 elements to collect quantitative thickness data. The gathered data will be analyzed based on the actual measured data from the tested areas and supplemented with statistical analysis (i.e., Extreme Value Analysis) to determine the minimum remaining thickness of the tank bottom, remaining life, and the interval before the next OOS. This paper discusses the validation process of robotic analysis results (EVA) results against the results obtained from the conventional Ultrasonic Testing Thickness Measurement (UTTM) conducted on the raw water tank at one of the refineries. The robotic inspection is conducted during tank in-service, whereas the conventional NDE was conducted during a scheduled shutdown. A comparison of both methodologies revealed that the minimum thickness variance was approximately 6%, with a similar corrosion rate. Verification with UTTM data at two locations showed an acceptable thickness variance of 3-5% between the two methods. In summary, the analysis demonstrates that robotic tank floor inspection supplemented by EVA shows comparable alternative for online inspection in providing accurate and reliable data to conventional NDE.

Keywords : Non-Destructive Examination (NDE), Ultrasonic Testing (UT) Ultrasonic Testing Thickness Measurement (UTTM), Magnetic Flux Leakage (MFL), Remaining Life, Out of Service (OOS), Extreme Value Analysis (EVA)

PAPER 7A

ATMOSPHERIC STORAGE TANK IN-SERVICE ROBOTIC INSPECTION: API 653 COMPLIANCE AND AVOIDING TANK SHUTDOWN

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Abstract

Operating units often face challenges when managing atmospheric storage tanks out of service, which includes long downtime, high costs and safety risks. Compliance to API 653 standard (Tank Inspection, Repair, Alteration and Reconstruction) is a requirement for tank owners, and using new technologies, tank inspection can be conducted without stopping production. Conventional approach during tank out of service includes visual inspection by API 653 inspector, ultrasonic testing thickness measurement for shell and roof, magnetic flux leakage (MFL) inspection for tank bottom thickness measurement and tank bottom settlement survey. Robotic technologies enable the inspection of tank components without taking them offline, thereby avoiding the opportunity cost of removing an asset from service. Robotic crawlers, equipped with ultrasound and high-definition cameras, can externally inspect tank shells and roofs to detect any sign of corrosion, pitting and other damage to base metal. Mini ROV, equipped with high-definition cameras, can internally inspect tank shells, roofs and bottom plates while submersible robotic crawlers can perform ultrasonic testing on tank floor. By performing quantitative assessment of the tank floor and statistical analysis, the in-service robotic inspections meet API 653 requirements, allowing plant owner to avoid tank shutdown for integrity assessment.

Keywords : Storage Tank, API 653, internal in-service inspection, robotic inspection, NDT robot

PAPER 8A

OPENVISION METHOD FOR REAL TIME CUI INSPECTION

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Abstract

Corrosion under insulation (CUI) is an ever-increasing concern of operations managers, integrity managers, and owners of refineries, petrochemical facilities, power plants, etc. where insulated piping is prevalent. The increased awareness among asset owners of the CUI problem drives ever increasing demand for CUI detection and monitoring solutions. Many CUI inspection methods are currently available to asset owners and NDE service providers for incorporation into CUI programs; each with specific capabilities and limitations. Selecting which method(s) to employ depends on both the physical characteristics of the assets to be inspected and client key performance indicators (KPIs) for CUI inspection. Physical characteristics include insulation material and thickness, cladding material and thickness, accessibility of inspection location, condition of insulation and pipe surface, and discontinuities in piping systems (e.g., flanges, hangars, elbows, etc.). Client KPIs include probability of detection, qualitative versus quantitative testing, and inspection rates. The capabilities of a CUI inspection method must be clearly understood to ensure client expectations are met for a particular CUI application. This paper focuses on the OpenVision method of real time radiography utilizing a live video x-ray system for high speed, truly non-destructive screening of insulated piping targeting corrosion or indications of corrosion on external pipe surfaces. Capabilities and limitations of the OpenVision method will be presented supporting practical examples and case studies. Additional applications of the OpenVision method such as weld location in conjunction with alloy identification for PMI will be introduced.

Keywords : corrosion under insulation (CUI), real-time radiography (RTR), OpenVision

PAPER 9A**DEEP LEARNING FOR LASER ULTRASONIC WAVE PROPAGATION IMAGES AND AN ATTEMPT TO
DETECT A DEFECT IN CONCRETE MATERIALS**Takahiro Saitoh¹, Sohichi Hirose²¹Gunma University²Tokyo Institute of Technology**Abstract**

In recent years, nondestructive testing for civil engineering structures has become increasingly important. Ultrasonic testing is one of the nondestructive inspection methods for civil structures. However, the inspection of civil engineering structures takes much time due to the extensive scope of the inspection. Moreover, in the field of nondestructive testing, there are also concerns about a future shortage of inspectors, so an innovative and effective nondestructive method needs to be developed. Therefore, this study proposes an automatic defect detection approach using a pre-trained convolutional neural network (CNN) for laser ultrasonic visualization testing (LUVT). LUVT can visualize transient ultrasonic wave propagation in the laser irradiation area and save it as image data. The main purpose of this research is to create an AI using a deep learning to detect a defect in image data obtained by LUVT. The images obtained by both LUVT and the 2-D finite element method (FEM) are used for the deep learning. The effectiveness of the proposed method is confirmed by applying it to a concrete material with a defect. Grad-CAM demonstrates that the CNN model created in this study accurately predicts the position of a surface defect on concrete specimens. Some CNN results demonstrate that the developed AI accurately predicts the presence or absence of a defect in concrete materials with high precision.

Keywords : Laser ultrasonic waves, Laser ultrasonic visualization testing, Deep learning, Grad-CAM

PAPER 10A

OPTIMISING LOW-FREQUENCY PHASED ARRAY ULTRASONIC TESTING (PAUT) TECHNIQUES FOR CHARACTERISATION OF DEFECTS IN GLASS FIBER REINFORCED POLYMER (GFRP)

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Abstract

Glass Fiber-Reinforced Polymer (GFRP) is widely utilised across various industries due to its exceptional strength-to-weight ratio, corrosion resistance, durability, and cost-effectiveness. Nevertheless, GFRP structures are susceptible to structural failures during manufacturing and operation. Non-destructive testing (NDT) methods, such as Ultrasonic Testing (UT), are essential for detecting these failures despite challenges posed by fibre orientation, inhomogeneity, and attenuation within GFRP. Existing studies have identified difficulties in defect assessment due to low resolution and near-field effects. This study addresses a critical research gap in UT methods for GFRP by exploring the efficacy of Phased Array Ultrasonic Testing (PAUT) using a 1.0 MHz low-frequency transducer. The GFRP sample, created via filament winding with type E-glass fibres and polyester resin at a 54° angle, was initially verified to be defect-free using UT. A standard reference block with a curved shape, produced according to NORSO M-622, 2005 standards, was assessed using a PAUT transducer (1L64-96X2215). Results demonstrated that Time Corrected Gain (TCG) significantly enhanced the signal-to-noise ratio (SNR). Thickness measurements ranged from 15.0 mm to 19.0 mm, with signal amplitudes exceeding 100% Full-Screen Height (FSH) on the A-scan. The study encountered difficulties evaluating Flat-Bottom-Hole (FBH) diameters (20.0 mm to 16.0 mm) at a 5.0 mm depth due to poor resolution and near-field effects. PAUT results indicated that as GFRP thickness increased, amplitude height also increased. The study found that artificial defects in bonded regions decreased the signal-to-noise ratio, complicating evaluations. The research underscores the effectiveness of low-frequency PAUT probes for assessing thickness, identifying defects, and evaluating bonding quality in GFRP. It highlights the importance of proper setup and calibration, especially considering the curved surface of GFRP. This study provides valuable insights into the potential use of low-frequency PAUT for GFRP, which could lead to the development of more efficient NDT methods for GFRP. Consequently, this could enhance the safety and reliability of GFRP structures.

Keywords : Composite, GFRP, NDT, Low-frequency PAUT, Ultrasonic Testing, UT, Phased Array Ultrasonic Testing, PAUT,

PAPER 11A**SOLVING 2D CORROSION MAPPING ULTRASONIC INSPECTION CHALLENGES**

Simon Alain

EVIDENT

Abstract

Ultrasonic corrosion mapping inspection using conventional single-element UT probes is slow and does not provide high data density. To enable inspections of large areas using conventional UT, a configuration requiring complex, expansive, and difficult-to-set up motorized scanners is necessary. Thanks to the wider beam coverage of phased array ultrasonic testing (PAUT), this technique has gained popularity in recent years for corrosion mapping, as it helps achieve higher inspection rates while increasing data quality. Although the wider beam is an advantage, the probe still needs to be moved sideways between each scan line to perform 2D mapping of the region to be inspected. To encode the probe's position on two axes, a typical phased array search unit needs to be mounted on an external dual encoded scanning system, adding further costs and complexity to the inspection. Evident has developed a solution to this problem—a new phased array scanner with two integrated encoders to record its position on the part for both x- and y-axis scanning, thereby removing the need for an auxiliary scanner. This presentation will provide details on the different innovations implemented in this new system and explain how it can be used to increase productivity and data quality while reducing the costs and complexity of 2D corrosion mapping.

Keywords : PAUT, corrosion mapping, scanner, integrated encoders

PAPER 12A**BUILDING TFM PROCEDURES FOR ERW HOOK CRACK, GIRTH WELD, HTHA AND OTHER CHALLENGING INSPECTION**

Emilie Peloquin

EVIDENT

Abstract

Full matrix capture (FMC) and the total focusing method (TFM) have shown improvement in specific applications in the past few years. However, inspectors using this method are still subject to trial and error to achieve good results. Challenges with TFM inspection include selecting a propagation mode to minimize blind spots, confirming the angle of reflection, and optimizing for preferential gain direction. In particular, choosing the most appropriate mode of propagation (i.e., the imaging path) is critical for an effective TFM inspection, and it requires extensive procedure development on simulation software to help ensure proper detectability and perpendicularity of the beams with the reflectors (defects). The Acoustic Influence Mapping (AIM) simulator is a theoretical amplitude representation (color map) of the region, mode of propagation, and type of reflector selected. With this tool, multiple imaging paths can be combined to obtain the optimal probability of detection (POD) for a given indication or damage mechanism.

In this paper, we describe a wave propagation modeling technique that calculates the predicted signal response in the TFM zone for both pulse-echo and self-tandem modes of propagation. Some specific applications will also be highlighted and will show how the AIM tool can help identifying hook cracks in electric resistance welding (ERW) where defects can appear in various orientations to the scanning surface or in high-temperature hydrogen attack (HTHA) where micro-fissuring can grow in different directions and unexpected location within the part.

Keywords : PAUT, FMC, TFM, ERW, Acoustic Influence Mapping (AIM)

PAPER 13A**MATRIX ARRAY ULTRASONIC TESTING (MAUT)**

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¹Dolphitech

²Advantech Alliance Sdn Bhd

Abstract

Ultrasound NDT (Non-Destructive Testing) has existed for over a century and is widely used in several market segments for many applications and for many types of material. In the beginning, one simply used a single element transducer to interpret a single pulse-echo signal known as the A-scan. This technology or method is today referred to as "conventional UT" or Ultrasonic Testing. Later, 1-D Array transducers were introduced, and is today referred to as "PAUT" – Phased Array Ultrasonic Testing. The industry refers to it as "phased array" since you can steer or phase the ultrasound beams by delaying the transmitting of each transducer element. About a decade ago, the Norwegian company, Dolphitech, introduced the Matrix Array Ultrasonic Testing (MAUT) which is a row-column (2D Array) transducer principle. After a decade in the industry, MAUT has grown to be an accepted alternative ultrasound technology. One of the latest standards for MAUT is ASTM E3370-22 "Standard Practice for Matrix Array Ultrasonic Testing of Composites, Sandwich Core Constructions, and Metals".

Keywords : matrix array ultrasonic testing

PAPER 14A**OPTIMIZED DETECTION AND SIZING OF PIPELINE CORROSION AT SUPPORTS USING GUIDED WAVE TECHNOLOGY**

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Guided Ultrasonics Ltd.

Abstract

Corrosion under pipe supports (CUPS) represents one of the most prevalent pipe defects encountered across oil, gas, and petrochemical facilities, posing serious risks of pipeline structural failure and ultimately product containment loss. Despite being external in nature, locating CUPS remains a formidable task due to the sheer number of pipe supports per pipeline, often numbering in the hundreds. Conducting visual testing for each support proves impractical, particularly when pipes are elevated on racks or insulated. Addressing this challenge, this paper introduces an optimized methodology for CUPS detection and sizing. This approach integrates a broadband guided wave screening technique, ensuring reliable detection of CUPS over extensive pipe lengths. Additionally, a guided wave scanning technique is employed for precise quantification of the remaining pipe wall thickness at corrosion sites. The efficacy of this method is demonstrated through inspection results obtained from an 8-inch pipeline situated on a pipe rack within a petrochemical complex, identified as a critical asset by its owner. These results showcase the early detection of several CUPS defects and provide insights into the extent of damage in terms of remaining pipe wall thickness. Through the synergistic utilization of guided wave screening and scanning techniques, this methodology offers a robust solution for enhancing CUPS detection and facilitating proactive maintenance strategies within industrial facilities.

Keywords : pipe corrosion detection

PAPER 15A**THE USE OF SEGMENTED MAGNETO-STRICITIVE TOOLS FOR MEDIUM RANGE ULTRASONIC
INSPECTION OF PIPELINES**

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Abstract

Guided Wave Testing (GWT) or more specifically Long Range Ultrasonic Testing (LRUT) of pipeline is a widely accepted and standardized NDT method of inspecting pipelines for corrosion. This technique uses guided waves with a predetermined sensitivity (usually 5% Cross sectional Area) to inspect long lengths of pipes and this sensitivity will limit the range of testing. There are two main benefits for using this technique for screening pipelines for corrosion. Firstly the productivity of the technique is much higher than most localized and mapping NDE methods. Secondly, direct access to the pipe is only required at the tool location, allowing GWT to inspect inaccessible areas that are currently difficult using more conventional approaches. There are applications where range is not the most important criteria but higher sensitivity and resolution is the main requirement and GWT using higher frequencies has now a lot to offer in this area. This paper will look at the improvements made in this technique over the last number of years particularly on the higher frequency Medium Range Ultrasonic Testing (defined as testing at >100kHz). Conventional piezoelectric transducers are limited to frequencies below 100kHz and using Magneto-strictive transducers is more practical. Magneto-strictive transducers are not new and have been available for deployment for many years however they have always been limited with respect to being able to position defects circumferentially and the extent around the pipe. This limitation has now been overcome by using a segmented tool allowing for similar operation and processing as the well-established piezoelectric based GWT. This is particularly useful because the Magneto-tools developed can be dry-coupled, which is good for productivity as they require no bonded components or couplant. Also the segmentation of the tool allows for circumferential analysis of the signal which can be related to circumferential extent of defects using both CScan imaging and focusing in a similar way to the lower frequency methods. The advantages of higher frequency is that there are improvements in sensitivity, resolution and really opens up the ability of inspecting pipes over a shorter length but with much higher sensitivity, detectability and resolution making it a desirable method for alternative applications. Suitable applications include; small diameter pipe supports, stainless steel inspection or inspection of flanged pipe and sprinkler pipes.

Keywords : Guided Wave Testing, Long-Range Ultrasonic Testing, Medium Range Ultrasonic Testing, Pipeline Inspection, Corrosion Under Insulation, Non-Destructive Testing

PAPER 16A**ROADMAP TOWARD HDPE PIPE JOINT INTEGRITY ASSURANCE VIA ADVANCED NDT SOLUTIONS**

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M Afiq B Mansor, M Zaparel B Awang

PETRONAS

Abstract

Oil and Gas facilities often use different metallic materials, but corrosion is a major issue that causes the metal to lose mass over time and alter its original design integrity. Plastic (High-density polyethylene - HDPE, GRP, GRVE, etc.) gained attention as a possible material of construction for pressure-containing systems as it offers a more sustainable, non-corrosive and affordable options. One of the joining methods is electrofusion welding. Pipe joint integrity assurance can be achieved via good engineering as per codes, standards and Recognized and Accepted Good Engineering Practices (RAGAGEP). It covers materials selection to ensure that materials is compatible with the service fluids to which it is exposed over the full design range (including pressure and temperature) so that the mechanical, physical and chemical properties of the system will satisfy the design requirements throughout its intended lifetime. Qualification of HDPE piping system shall be based on the hydrostatic design stress requirement as per ASTM D2837. Pipe Class for varies pressure rating is established to govern the overall design of piping system for its intended service conditions. Pipe Joint integrity assurance can also be achieved with proper quality control in the manufacturing and installation work. Visual examination and hydrostatic pressure testing are required after completion of HDPE electrofusion welding joints, and additional NDE with advanced techniques on the selected joints are needed to enhance integrity assurance for the high critical piping system. A specialized and patented Phased Array Ultrasonic Testing (PAUT) system is developed for this purpose. Detailed review of the techniques, procedures and personnel qualifications, equipment verification, calibration block and techniques, coverage and scanning techniques etc. were conducted among the experts from manufacturers, NDE testing and certification bodies and subject matter experts, with the references to the related codes and standards especially E3170 Standard Practice for Phased Array Ultrasonic Testing of Polyethylene Electrofusion Joints. Implementation of good engineering and advanced NDT solutions are essential journey towards HDPE Pipe Joint Integrity Assurance.

Keywords : Pipe Joint, Integrity Assurance, Advanced NDT

PAPER 17A**DIFFERENT APPLICATION OF ULTRASONIC C-SCAN INSPECTION**

Cynthia Zuo

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Abstract

Ultrasonic water immersion C-scanning is a non-destructive inspection technique that does not cause any damage to the object being inspected, primarily used to detect defects and structural features in materials. It can be applied to the detection of various materials, such as metals, ceramics, glass, rubber, composites, etc., for the detection of defects, cracks, holes, etc. in them. UT water immersion C-scanning can be used to inspect newly produced parts to ensure that their quality meets the standard requirements, and also detect aging parts to determine whether they need to be replaced or repaired. It is widely used for the inspection of various components in the machinery manufacturing industry, in the aerospace industry for the detection of various aviation devices, in the automotive industry for the detection of various parts and various electronic components in the electronics industry, providing precise information about defects or structural features and can accurately determine the type and location of detected defects or cracks.

Keywords : UT, C-Scan, water cooling plate, EV cars, electronics

PAPER 18A**ADVANCING NDE 4.0: THE INNOVATION OF PORTABLE ULTRASONIC FLAW DETECTOR**

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Abstract

Ultrasonic Testing for industrial applications has grown a long way in the past 75+ years from the evolution of bigger analog devices to modern digital electronics based ultra-portable flaw detectors. Portable flaw detectors made the ultrasonic inspections lot easier by carrying it to the remote and confined location for inspection data recording and further decision making. Now with the evolution of the digital era and due to pandemic, the industries are investing on the digitization, digitalization, and digital transformation to accelerate the growth of industry 4.0 and hence the NDE 4.0. NDT industry is facing the challenge of data integrity, challenges in data storage and sharing, prolonged process of report generation and maintaining the historical data in physical format. In this paper we will discuss about how the ultrasonic flaw detectors contributes on NDE 4.0. Cloud connected modern days ultrasonic flaw detectors unleash the digital potential by making the devices to talk to each other on a centralized cloud platform to store, collaborate and share ultrasonic dataset for numerous benefits. Digitally connected ultrasonic flaw detectors can provide the wholistic data-driven approach for industrial ultrasonic inspection; Increase inspection productivity; reduce human error and rework; efficient inspection fleet management; ensures the data integrity and advanced reporting.

Keywords : ultrasonic testing, portable flaw detector, digitization, digitalization, digital transformation, industry 4.0, NDE 4.0, data integrity, advanced reporting

PAPER 19A**SOFTWARE AND HARDWARE ADVANTAGES OF ULTRASONIC C-SCAN INSPECTION SYSTEM**

Alaina Qi

Shanghai Newlite Industrial Co.,Ltd

Abstract

We are Shanghai NEWLITE Industrial Co., Ltd. from China. The Ultrasonic C-scan Inspection System is our company's main product. The Ultrasonic C-scan Inspection System is used for internal defect detection of corresponding products in materials science, processing technology and welding process. It uses servo motion control system to drive ultrasonic transducer for water immersion C-scan detection of products, collecting full wave of ultrasonic signals and using the imaging algorithms and data image processing functions to effectively identify defects inside the product, obtain clear images of the interior and statistically analyze the defect location, shape and size to generate custom reports. Our software and hardware have significant features. On the software side, the features include collecting the full wave of ultrasonic signals, providing any sectional view, generating customized reports, and enabling remote upgrade. In terms of hardware, we use marble platforms and linear motor modules to ensure the accuracy and stability of inspections. At the same time, we focus on the durability and reliability of the equipment, which undergoes strict quality testing and optimization to meet the needs of customers for long-term use. We are committed to providing customers with high-quality, high-performance inspection systems to help various industries improve product quality and production efficiency.

Keywords : software and hardware

PAPER 20A**DEFECT DETECTION OF NON-METALLIC MATERIALS USING MATRIX ARRAY ULTRASONIC TESTING**

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Advantech Alliance Sdn Bhd

Abstract

Non-metallic and composite materials properties contribute to the increased installation and new development of non-metallic materials in the various industries. The material strength, weight and corrosion resistance are some of the properties that the industry attracted to. Such material might be glass fibre reinforce epoxy/plastic (GRFP/GRE), carbon fibre reinforced plastic (CFRP) or even high-density polyethylene (HDPE). However, some of the material is attenuative in nature and vast variation of fabrication formula possess challenges in inspecting them either after installation or even after fabrication. This imposes concerns for fabricators and asset owner on the quality and safety of the non-metallic / composite parts. Development of Matrix Array Ultrasonic Testing (MAUT) by Dolphitech which utilizes a 2D matrix array transducer. The initial development was to cater aerospace industry which then generates opportunities to renewable energy and oil and gas. The versatility of the technology is not limited to non-metallic and composite materials, it also capable to inspect metallic material for application such as corrosion mapping. The transducer with 128 x 128 element crossing electrode which during operation will produces 16,384 A-scans. With the vast A-scan collected and the data construction from it together with full matrix capture (FMC), the defect detection is improved with data representation in A-scan, B-scan, C-scan and live 3D representation. The data representation gives more confidence to the inspector in making quick decision.

Keywords : matrix array ultrasonic testing, non-metallic

PAPER 21A**TOTAL FOCUSING METHOD (TFM) AND PHASE COHERENCE IMAGING (PCI) APPLIED FOR WELD
INSPECTION AND HTHA ASSESSMENT**

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Eddyfi Technologies

Abstract

Imaging techniques based on ultrasonic Total Focusing Method (TFM) are more and more applied for industrial applications. Adoption of the technique has been made easier with the publication of the revised ASME V and ISO 23864 and 23865 standards. TFM is an inspection technique that involves two steps: the first one is the data acquisition process called Full Matrix Capture (FMC) and the second one is the data reconstruction itself called TFM. FMC/TFM can be done in post-processing or in real-time, but it is really the latter that allowed the democratization of the technique. The FMC consists in recording all possible signals from every transmitter-receiver pair of elements in the array. By using a delay and sum beam-forming operation of the FMC, TFM is able to produce to focus the energy at every pixel within a region of interest providing a high-resolution image. Efforts have been made to improve the productivity of the technique using various excitation modes such as Plane Wave Imaging (PWI) to reach scanning speeds comparable to standard phased-array inspections while maintaining code compliance. While TFM is based on the extraction of the amplitudes of the signals of the FMC matrix, another technique called Phase Coherence Imaging (PCI) uses the phase information from those signals. The PCI image shows high values when all the elements contribute in phase. This is the case for small diffractors that tend to send energy in all directions such as very small defects, cracks (HTHA, porosities...), and tips from cracks and other planar reflectors. At the opposite, specular echoes tend to be minimized since few elements contribute to the echo. In this presentation, the advantages of both techniques on various industrial cases will be shown

Keywords : TFM, PCI, HTHA

PAPER 1B**DEVELOPMENT OF X-RAY EXPOSURE CHART PHOPORUS-BASED IMAGING PLATE FOR STEEL MATERIAL**

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Khairul Anuar Mohd Salleh¹, Arshad Yassin¹, Mohd Junaidi Jaapar¹

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Abstract

An exposure chart serves as a critical tool for correlating exposure time with the strength of the radiation source and the thickness of the material being tested. It aims to ensure consistent image quality across various examinations and imaging systems. Traditionally, exposure charts were designed for X-ray machines that utilized film as the imaging medium. However, with the advent of digital imaging, imaging plates (such as those used in Computed Radiography systems) have replaced films, allowing for the creation of digital images. These digital images can be electronically stored, eliminating the need for physical film storage and streamlining image retrieval processes. While digital imaging has significantly advanced the field, comprehensive exposure charts specifically tailored for phosphor imaging plates in industrial applications are still lacking. This study addresses this gap by creating an exposure chart using a steel step wedge and a white imaging plate (equivalent to D7 film) for the Isovolt Titan E x-ray machine. To calibrate the system, we determine the minimum gray value (GVmin) and energy using a copper step wedge at a focal-detector distance of 100 cm and an energy level of 180 kV. Each step wedge is exposed to varying energy levels and constant current until the desired gray value is achieved. Subsequently, we construct an exposure chart based on steel thickness (measured in millimeters). The work simulates the same thickness of the exposure chart using aRTist software. By comparing the two exposure charts, we evaluate their performance using welded plates. The results demonstrate that an exposure chart can indeed be developed for phosphor imaging plates. Furthermore, the computed radiography system significantly reduces exposure time (by approximately 80%), making it quantitatively comparable to conventional film radiography.

Keywords : exposure chart; phosphor imaging plate; steel

PAPER 2B**DR SYSTEMS: INNOVATIVE TECHNOLOGIES IN INDUSTRIAL RADIOGRAPHY**

Mikhail Berdnikov

DR Systems LLP

Abstract

DR SYSTEMS is an international corporation specializing in developing, manufacturing, and marketing direct Digital Radiography (DR) systems for industrial inspection. These systems offer quick, reliable, and efficient X-ray imaging, providing significant advancements in non-destructive testing (NDT) by replacing traditional X-ray film and Computed Radiography (CR). The company boasts a multinational team with over 30 years of expertise in NDT, engineering, physics, modeling, and imaging, allowing them to innovate and enhance existing technologies. DR SYSTEMS offers a range of durable, easy-to-use digital radiography solutions for various applications, including oil and gas projects, aerospace, marine, military, production facilities, laboratories, security, and even museums and art galleries. They also customize systems to meet specific customer needs, such as underwater NDT, pipeline and tank inspection, and quality evaluation in manufacturing. Their advanced DR technologies aim to boost competitiveness and efficiency in numerous sectors.

Keywords : NDT, digital radiography, radiography testing, computed radiography

PAPER 3B**CONTROL AND REGULATION OF INDUSTRIAL RADIOGRAPHY ACTIVITIES IN MALAYSIA**

Halim Abdul Rahman

Jabatan Tenaga Atom

Abstract

Industrial radiography activities have been wisely practiced in Malaysia since 1990s in many sectors such as oil and gasses, shipping and aircraft, manufacturing and power generation industries. Its contributions to Malaysia development and economic growth are significant and important especially in those sectors. Since industrial radiography deals with ionizing radiation (Gamma and X-rays), according to Malaysian Law, the ionizing radiation application for these activities is controlled and supervised under The Atomic Energy Licensing Act 1984 (Act 304) which enforced by the Department of Atomic Energy (Atom Malaysia). The control and supervision mechanism comprise of an authorization (assessment and licensing), inspection and enforcement processes. In authorization process, the submission of documents such as Radiation Protection Program, Security Plan and Nuclear and Radiological Emergency Plan as well as the employment of Radiation Protection Officer (RPO) and the availability of Radiation Detection Instrument are mandatory requirements under The Act and its subsidiary legislations. To date, there are approximately 96 companies that carry out industrial radiography in Malaysia. Assessment of compliance with this activity is carry out through inspection activities consisting of periodic inspection and spot check (unannounced inspection). From 2019 to 2023, 313 periodic inspections have been carried out while 469 for spot check. The result of inspections found that there were 39 non-compliances committed by the inspected companies such as unlicensed possession, expiry of RPO recognition, dose exceeds the annual dose limit (more than 20 mSv in less than 1 year), careless handling of personnel dosimeter, lost of radioactive source, lost of personnel dosimeter, and expiry of operator's recognition. Those non-compliances that have been done lead to 40 regulatory actions taken against the company under the Act 304. Failing to properly handle personnel dosimeter is the highest non-compliance that occurs every year. However, based on the data reported from 2019 to 2023, the trend of non-compliance was found to decrease slightly by year even it increases again in 2023. Atom Malaysia always put the licensees' compliance to the Act 304 and its subsidiary legislations as well as the importance of maintaining radiation safety and security as the highest priority and these aims are pursued via various approach such as awareness training, engagement programs, guidelines development, inspections and etc.

PAPER 4B**THE DIGITAL X-RAY INSPECTION CHALLENGE AND HOW WE SELECT TECHNOLOGY**

Denis Kiesel

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Abstract

Using Digital imaging technology for Radiographs taken in the field has become a preferred method for many inspection companies and asset owners. The advantages of a direct X-Ray image, transferred from a Digital Detector to a portable image processor is fast and offers quick results at the spot. However, we must ask the question if we are not over-applying a technology for applications that we can solve better with CR or even analogue Film. A lot of tasks and setups are offering possibilities for a variety of approaches, even UT or robotic surface inspection with RVI. Therefore, we must develop proper methods to vet approaches to the issue we want to solve and apply what makes most sense for the task. This is a daily Job for many service providers that work on the assets. But often enough we are using a certain method simply because of the availability of an instrument, or we are constraint by a short-term budget that allows only certain instruments to be used for the approach. In a holistic project overview, developing the right method is key to safe results in a cost efficient and sustainable manner. It helps us grow methods to other areas and give space for a variety of solutions, leaving room for all, Film, CR, DR, manual, automated and assisted inspections, each with the right focus and outcome. Key to the enablement is the availability of all instruments and methods, the knowledge of all relevant standards and guidance, and an agreed consent between parties on the technology and approach that should do the job. We need to know why we do it in a certain way, and what weights have decided the way to go. It leads to transparency and trust on how we inspect. This Paper is making the effort to evaluate some reasons and difficulties for vetting a method and qualifying an approach. It uses fictive examples to illustrate the thought process and tries to help us understand a possible decision making. Waygate Technologies as part of Baker Hughes Industrial Energy Technology (IET) business and was formally known as GE Inspection Technologies as part of GE Measurement & Control. We understand the NDT business as Healthcare for Industry. In this spirit we have driven the digital conversion from the start, and are as a leader in this process constantly sharing our experience, progress, recommendation and outlook.

Keywords : Digital Imaging, Radiography

PAPER 5B**TRENDS AND NEW APPLICATIONS – PORTABLE X-RAY**

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Abstract

A walk through of the latest trends and applications within portable X-ray which has their root in technical improvements, applications as well as focus on regulations. As a one-man tool, to reduce labor costs, getting a faster and smarter workflow through easier to handling - while the small focal spot gives the possibility of shorter exposure times and increased image quality. What are the cost advantages and what does it mean to operate with light weight X-ray systems. As a supplier of portable X-ray equipment, we can see two separate trends in the market. For 160, 200 & 225kV portable X-ray equipment a strong demand for low weight solutions has been noted. This is caused by strong focus on labor regulations (one person are only allowed to lift 15kg) as well as protection of work force combined with increased throughput due to faster reposition of the tube head. 1mm focal spot (EN 12543) has also become the benchmark caused by the digital transition as well as higher demands for image quality and shorter exposure time due to reduced distance (elliptic technique). No matter if the task is inspection of aircrafts, pipelines or refineries, manual handling, reposition and mounting of the X-ray tube head is a significant part of the workflow. Low weight equipment in a sufficient quality not only increase the throughput but also getting more value out of the available workforce.

Keywords : Portable X-Ray, Comet, Mobile X-Ray

PAPER 6B**TANGENTIAL AND DOUBLE WALL RADIOGRAPHIC PIPE INSPECTION**

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Abstract

An overview of how the ISO 20769 standard is used in practice to perform inspection of pipes for corrosion using digital radiography (CR and DR). Both tangential (ISO 20769 Part 1) and double-wall (ISO 20769 Part 2) inspection techniques will be explained, with a focus on how software can be used to perform the evaluation efficiently.

Keywords : Radiography, NDT, Digital, Software, DDA, CR, Computed Radiography, Corrosion, Pipe, RT

PAPER 7B**ARTIFICIAL INTELLIGENCE (AI) FOR SMART AUTOMATED RADIOGRAPHIC TESTING (RT) WELDING
ANOMALY EVALUATION AND IMAGE FINGERPRINT ANALYSIS**

Mohd Zaini Mohd Zakaria, M Afiq B Mansor, Norzaila Bt Nordin,
M Baki B Mansor, Wan Abdullah B Wan Hamat
PETROLIAM NASIONAL BERHAD (PETRONAS)

Abstract

This paper outlines the development of Artificial Intelligence (AI) and Deep Learning (DL) algorithms in Radiographic Testing (RT) image interpretation of welding anomalies and duplication detection, specifically focusing on weld joints in oil and gas construction and fabrication. Typically, weld joints for piping, pipelines, pressure vessels, and storage tanks are examined to ensure their quality and integrity. RT is a commonly used inspection method under welding codes and standards. RT result assessment relies on qualified radiographic interpreters (RI) and third-party inspectors to ensure weld quality and assurance. However, the current practice heavily depends on human skills and experience, which can lead to errors and inconsistencies in RT film interpretation, ultimately affecting project quality, timelines, and equipment reliability. To address these issues, advanced algorithms leveraging AI and DL applications have been developed to enhance film image interpretation and streamline the review process. The algorithms are currently capable of detecting 11 common weld anomalies, achieving an impressive 91.0% overall defect detection accuracy and 84.7% classification accuracy. In addition, the model is also capable of analyzing welding anomalies according to specific acceptance criteria such as API 1104, ASME B31.3, and ASME Section VIII codes and standards. Another significant challenge in the industry is the sub-standard practice of RT performed by contractors during construction stage, which require lengthy review and assurance process to detect the risk of fraud. An innovative model algorithm has been developed to compare RT film images and weld profiles to authenticate RT image fingerprints for fraud prevention by utilizing AI. The model algorithm can identify key points in the images. Testing has shown that the model can authenticate and detect radiographic test (RT) image fingerprints with as low as 1% image similarity up to 100%. The success of these AI and DL model algorithms is attributed to extensive collaborative efforts between industry and academic partner.

Keywords : Artificial Intelligence, Deep Learning, Radiographic Testing, Weld Anomalies, RT Film Interpretation, Image Fingerprints

PAPER 8B**IMPACT OF SCANNING TIME DELAY ON RADIOGRAPHIC IMAGE QUALITY IN COMPUTED
RADIOGRAPHY FOR NON-DESTRUCTIVE TESTING**

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Abstract

The evaluation of radiographic image quality in Radiographic Testing - Digital (RT-D) is essential for accurately interpreting and assessing discontinuities in Non-Destructive Testing (NDT). This study investigates the impact of scanning time delay on the radiographic images produced by a Computed Radiography (CR) imaging plate under consistent exposure conditions. Scans were conducted immediately after exposure using the white CR imaging plate and at intervals ranging from 10 minutes to 64 hours. The plates were securely stored in a cassette and an imaging plate box post-exposure. Radiographic image quality was assessed in accordance with the ISO 17636-2 standard. The findings underscore the critical role of timely processing and careful handling in preserving the integrity of radiographic image quality in CR imaging. This research provides valuable insights into best practices for optimizing image quality in NDT applications.

Keywords : Non-Destructive Testing (NDT), Radiographic Testing - Digital, Image Quality, Computed Radiography (CR), Scanning Time Delay

PAPER 9B

ENHANCING STRUCTURAL LONGEVITY OF AGING MILITARY AIRCRAFT THROUGH NON-DESTRUCTIVE TESTING INSPECTIONS

Mej. Ir. Ts. Dr. Arvinthan Venugopal

Royal Malaysian Airforce

Abstract

In the domain of military aviation, the reliability and longevity of aircraft are not just matters of operational efficiency but also vital for national security. Aging military aircraft, often subjected to rigorous operational demands and harsh environmental conditions, face unique challenges in maintaining structural integrity over time. To address these challenges, non-destructive testing (NDT) inspections have emerged as a critical tool for enhancing the structural longevity of aging military aircraft while ensuring flight safety and operational readiness. This abstract explores the significance of NDT inspections in prolonging the lifespan of aging military aircraft, highlighting their methodologies, applications, and indispensable role in military aviation maintenance. NDT encompasses a diverse range of techniques designed to evaluate the material properties and structural health of aircraft components without causing damage. These techniques include radiographic testing, ultrasonic inspections, eddy current testing, magnetic particle testing, and visual inspections, among others. By leveraging these advanced methodologies, inspectors can detect flaws such as fatigue cracks, corrosion, and material degradation hidden beneath the surface of aircraft structures with precision and accuracy. The application of NDT inspections is particularly crucial in the maintenance of aging military aircraft, which are subjected to high-stress missions and harsh operating environments. By conducting periodic NDT assessments on critical components such as airframes, wings, landing gear, and propulsion systems, inspectors can identify and monitor the progression of defects, enabling timely interventions to prevent catastrophic failures. This proactive approach not only enhances flight safety but also minimizes operational downtime and maintenance costs, thereby ensuring optimal fleet availability and readiness. Furthermore, NDT inspections play a pivotal role in ensuring regulatory compliance with stringent safety standards mandated by military aviation authorities. These standards, set forth by organizations such as the Directorate General Technical Airworthiness (DGTA) and the Royal Malaysian Airforce (RMAF), require rigorous inspection protocols to maintain the airworthiness of military aircraft. By adhering to NDT techniques endorsed by these regulatory bodies, military operators can demonstrate compliance and uphold the highest standards of aviation safety and mission readiness. In conclusion, non-destructive testing inspections represent a cornerstone in the effort to enhance the structural longevity of aging military aircraft. By leveraging advanced methodologies and adhering to regulatory standards, NDT inspectors safeguard flight safety, minimize maintenance costs, and prolong the operational lifespan of military aircraft. As military aviation continues to evolve to meet evolving threats and operational challenges, the role of NDT inspections remains indispensable, ensuring the continued airworthiness and mission readiness of aging fleets in defense of national interests.

Keywords : Aircraft, aging, Non-Destructive Testing, fatigue, Corrosion.

PAPER 10B**PRELIMINARY WORK ON AUTOMATED DEFECT RECOGNITION ON IMPACT DAMAGE DEFECTS
IMAGES USING ARTIFICIAL INTELLIGENCE**

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¹Malaysian Nuclear Agency

²Technical University of Malaysia, Melaka

Abstract

Industrial Revolution 4.0 (IR 4.0) is about using modern technology to make industries smarter and working more efficiently. The revolution involve smart manufacturing, predictive maintenance, supply chain optimization, digital twin technology, 3D printing, autonomous robots, energy efficiency and sustainability and artificial intelligence. In this work, Artificial Intelligence (AI) algorithms are employed for the automated defect recognition process of the defects due to low velocity impact damage. Python coding is implemented and the tensor flow method is used in classifying the defects of the images. The data sets are non-defect and defect images of the damaged hybrid composites. It is found that the method employed in this work has the ability in recognizing the defects. Hence, AI plays a significant roles in recognizing defect without human intervention.

Keywords : Composite defects, Impact damage, Python, Automated Defect Recognition, Artificial Intelligence

PAPER 11B

HIGH-TEMPERATURE WELD INSPECTION USING ACFM® FOR IMPROVED PLANT INTEGRITY AND SAFETY

Charles Tremblay, Duncan Murray

Eddyfi Technologies

Abstract

Fatigue cracking in welds of high-temperature piping systems (up to 500°C) poses a significant challenge for petrochemical plants. Traditional Non-Destructive Testing (NDT) methods are limited by temperature and can miss critical cracks. This paper presents a novel solution using Alternating Current Field Measurement (ACFM®). Existing NDT techniques struggle to inspect welds in operational plants due to high temperatures. This necessitates costly shutdowns, hindering productivity and potentially leading to undetected cracks with safety risks. Eddyfi Technologies recently introduced a high-temperature ACFM® solution specifically designed for inspecting welds in carbon and stainless-steel components at up to 500°C. Key features include:

- Pre-calibrated probes for ease of use and eliminating hot reference calibration.
- Air-cooled probe design with overheating warning for optimized duty cycle and operator safety.
- 3BZ crack sizing technology enabling single-pass depth and length measurement.

The main benefits of the solution include:

- Reduced Costs: Avoids plant shutdowns for inspection, saving time and money.
- Improved Efficiency: Single pass crack sizing expedites inspection and decision-making.
- Enhanced Safety: Minimized operator exposure to hot environments through optimized duty cycle and contactless sizing.
- Better Asset Management: Accurate crack sizing allows for informed decisions on repairs and maintenance.

The high-temperature ACFM® solution offers a reliable and efficient method for inspecting welds in operational plants at elevated temperatures. This translates to improved plant integrity, safety, and overall cost-effectiveness.

Keywords : High-Temperature Inspection, ACFM®, Fatigue Cracking, Weld Inspection, Non-Destructive Testing (NDT)

PAPER 12B**NDT 4.0 TECHNOLOGY TRANSFORMATION, WITH THE PRACTICE TO RESEARCH OF NDT IN MALAYSIA.
DETECTION OF STRENGTH AND WEAKNESS IN CONTEXT OF PRESENT SCENARIO**

Sujit Chakravarty, Khairul Anwar Bharum

Velosi (M) Sdn. Bhd.

Abstract

Non-Destructive Evaluation 4.0 (NDE 4.0) are we ready? "Testing, Testing, Testing," Call for RT-PCR tests for detection of COVID-19 in early 2020 by Dr. Tedros Adhanom Ghebreyesus (World Health Organization Director General). Massive diagnostic test requirement came into scenario, so quick and so sudden that nobody would have expected. Non-Destructive Testing 4.0 (NDT 4.0) at least is not so sudden in appearance. Moreover, it is a definite direction towards transformation of NDT industry is moving forward. Malaysia as a booming NDT market can transform from consumer to inventor of technology. Currently the practice of NDT in Malaysia is more in application, and we need to transform it towards research-oriented business. Young researchers are ready to take over the task, they only need some specialized guidance counselling. The NDT nodal agency in Malaysia, Malaysian Society for Non-Destructive Testing (MSNT) plays a huge role in this transformation process. Let us transform our mindset from consumer to creator. Academicians and professionals together can achieve this goal. This paper will lay down the first necessary step to make it a success.

Keywords : Technology Transformation; Research in NDT; Consumer of NDT Market; Successful Transformation.

PAPER 13B**ENHANCING CALIBRATION ACTIVITY: IMPORTANCE OF TRACEABILITY IN ISO/IEC 17025:2017 AND
NON-ISO LABORATORIES**

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C. Melchers GmbH & Co.

Abstract

This paper explicates the important role of traceability in calibration activities for ISO/IEC17025:2017 accredited laboratories and non-ISO laboratories. Traceability is one of the main structures of metrology, ensuring the reliability and accuracy of measurement results. ISO/IEC 17025:2017 is designated for the quality management system of calibration and testing laboratories. ISO/IEC 17025:2017 emphasizes the requirements for establishing and maintaining traceability, providing more confidence in measurement results. On the other hand, non-ISO laboratories may lack policies for traceability requirements. This might affect potential inconsistencies in traceability practices and impact the uncertainty of measurement results. This paper will explain the significance of traceability in both types of laboratories while highlighting the advantages of ISO/IEC 17025:2017 accredited laboratories in complying with traceability frameworks and ensuring reliable measurement results.

Keywords : NDT, calibration, ISO/IEC 17025:2017

PAPER 14B**APPLICATION OF ACOUSTIC EMISSION TESTING AND ACOUSTIC PULSED REFLECTOMETRY
TECHNIQUE BY ARISE STAR SDN BHD**

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Arise Star Sdn Bhd

Abstract

Acoustic Emission (AE) and Acoustic Pulsed Reflectometry (APR) are both non-destructive testing (NDT) techniques that utilize sound waves to inspect and monitor the integrity of structures and materials. Despite their similarities in using acoustic waves, they serve different purposes and operate based on distinct principles. Both methods provide real-time data on the condition of the structure. This capability is crucial for early detection of defects, allowing for timely maintenance and prevention of catastrophic failures. By enabling early detection of defects and continuous monitoring, both AE and APR contribute to the safety and longevity of structures and systems. This reduces the risk of unexpected failures and enhances overall operational safety. AE and APR require sophisticated data analysis to interpret the acoustic signals. This typically involves advanced signal processing techniques and often requires skilled experts to accurately diagnose and locate defects.

METHODS

- 1. Acoustic Emission testing**
 - 1.1 Principles and Operation:** A. Mechanism: AE detects the release of energy from localized sources within a material. When a material undergoes deformation, cracking, or other forms of stress, it emits high-frequency sound waves. AE sensors capture these waves. B. Signal Generation: The sound waves are generated naturally by the material itself due to internal changes such as crack formation, plastic deformation, fibre breakage, or other stress-induced activities. C. Detection: AE sensors placed on the surface of the structure pick up these sound waves, which are then analysed to determine the location, intensity, and nature of the defect.
 - 1.2 Sample Success Story of AET [Photo]**
- 2. Acoustic Pulsed Reflectometry**
 - 2.1 Principles and Operation:** A. Mechanism: APR involves sending an acoustic pulse through a structure and analyzing the reflections that occur at points where there are changes in the cross-sectional area (e.g., blockages, cracks, or leaks). B. Pulse Generation: A pulse is generated by an acoustic source and propagated through the structure. C. Reflection and Detection: When the pulse encounters a defect or discontinuity, part of the acoustic energy is reflected back. These reflections are captured by sensors. D. Analysis: The time delay and characteristics of the reflected pulses are analysed to locate and identify the nature of the defect.
 - 2.2 Sample Success story of APR Application**

Keywords : AET, APR

PAPER 15B**ADVANCED TUBING INSPECTION THROUGH MACHINE LEARNING IN NON-DESTRUCTIVE TESTING**

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Eddyfi Technologies

Abstract

Today's non-destructive testing industry, including the oil and gas, petrochemical, and balance of plant operations, faces a daunting challenge: an aging workforce and growing shortage of skilled professionals specializing in the inspection of shell-and-tube heat exchangers. This shortage is most pronounced for certified Level II analysts capable of analyzing the data collected. Data analysis is complex, time-consuming, and prone to human error. At the same time, demands for accelerated inspection campaigns continue to grow. In response, the industry needs innovative tools that simplify data interpretation, increase analyst efficiency, and improve consistency and confidence in results. While assisted analysis for electromagnetic tube inspection has been around for several decades, existing solutions, whether described in the literature or commercially available, have been predominantly focused on eddy current testing (ECT) for steam generator tube inspection. These solutions primarily rely on rule-based detection algorithms that take into account the phase angle, amplitude, and relative position of the probe within the tube. However, these approaches are limited when inspection conditions are less controlled, as is often the case in the field - uneven pulling speeds, incomplete tube scans, lack of encoded position data, or insufficient information about the tube bundle configuration, including unknown detailed landmark tables and re-tubed sections. These common inspection challenges, shared across industries beyond nuclear applications, compromise the efficiency and reliability of data interpretation. This presentation presents the latest developments and performance metrics in the application of artificial intelligence and machine learning to overcome these limitations. It presents a flexible and robust detection engine capable of adapting to evolving inspection conditions. The algorithm performs landmark localization and potential defect identification. The paper includes typical implementation results for ECT in terms of defect detection probability and generic time reduction in the analysis process using integrated productivity tools.

Keywords : Artificial Intelligence, Machine Learning, Eddy Current Testing, Tubing, Analysis, Nondestructive Testing

PAPER 16B**THE REVOLUTION IN QUALITY CONTROL**

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ibg Swiss AG

Abstract

ibg NDT Technology leads the field in enhancing industrial quality assurance by merging traditional eddy current testing technology with cutting-edge artificial intelligence (AI) and innovative optical sensors. This approach marks a significant evolution from the standard eddy current method, which uses electromagnetic fields to detect both visible and non-visible defects, such as cracks or inhomogeneities within metallic components. The defects are identified through disruptions in the material's electromagnetic properties. The integration of AI improves this process by enabling rapid analysis of massive datasets and identification of patterns unnoticeable to human inspectors. This capability is boosted by machine learning algorithms that continually refine and enhance the inspection methods, thus elevating the accuracy and reliability of results. The latest addition to this technology suite includes advanced optical sensors known as iORS, which employ image processing to pinpoint and categorize even microscopic defects on surfaces. This technological synergy significantly bolsters automated testing processes, notably in the examination of screws, semi-finished tools, and ball bearings. Such advancements not only hasten defect detection but also contribute immensely to minimizing waste, reducing downtime, enhancing product safety, and upholding rigorous quality standards. As ibg NDT Technology harnesses these progressive tools, it solidifies its status as a pivotal entity in the realm of inspection systems, adeptly navigating the evolving demands of industrial landscapes and steering towards a future where smart factory environments can consistently deliver zero-defect outputs.

Keywords : Eddy Current Testing ; Artificial Intelligence (AI); Optical Sensors; Quality Assurance; Machine Learning; Detection of flaws; Automation; Industrial Production; Smart Factory

PAPER 17B**FINITE ELEMENT METHOD SIMULATION OF TIME DOMAIN PULSED EDDY CURRENT TECHNIQUE ON
FERROMAGNETIC PLATES**

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Malaysian Nuclear Agency

Abstract

Pulsed eddy current (PEC) is an advanced Non-Destructive Testing (NDT) technique that uses transient waveform for their coil excitation. It has the advantage of gathering different depth information in a single excitation process, thus provide the solution towards the drawbacks by both single and multi-frequency eddy current testing. In this work simulation investigations on PEC were conducted to establish the correlation between PEC signals and different defect i.e. crack, depths in ferromagnetic plates. Initial FEM simulation work has provided understanding of the underlying phenomena of the PEC results through the visualisation of the induced eddy current and defect interaction in the SS 304 sample. Features from the differential magnetic field transient profiles have provided information of the crack in terms of its depth and location. The understanding of the PEC responses and results can be extended for future work in quantitative evaluation of defect in conductive samples by PEC.

Keywords : Non-destructive testing, pulsed eddy current, electromagnetic

PAPER 18B**NDT FOR STEEL WIRE ROPE: APPLICATIONS AND STANDARDS**

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Abstract

Non-destructive inspection of steel wire ropes becomes quite common for onshore and offshore operations, and relevant equipment is now available on the market. The reason for growing interest to this inspection is increasing in prices for wire ropes, especially for ropes of large diameter, which may not be considered as consumable product anymore, but as assets, and thus should be discarded for reason, i.e. according to discard criteria and their actual technical condition. The key issues for wire rope non-destructive inspection are prompt equipment and correct data interpretation. Rugged and reliable equipment capable to make data interpretation with computer without human intervention is of interest of many customers. INTRON PLUS LTD. has developed INTROS-AUTO, that is a successor of widely used wire rope tester INTROS. It is designed for non-destructive inspection of wire ropes with automatic data interpretation. Following criteria are used to discard rope – number of broken wires along lay length and loss of metallic cross section area in percentage. Discard criteria can be adjusted according to agreement with the customer. INTROS-AUTO stores detailed data, which can be downloaded and interpreted in regular manner. The instrument is ready for inspection of ropes as large as 135 mm in diameter and can be used for periodical or permanent wire rope monitoring onshore and offshore.

Keywords : INTRON, Wire Rope

PAPER 19B**ENHANCED 3D MEASUREMENT OF ORBITAL WELDS IN CONFINED SPACES USING ADVANCED IMAGE PROCESSING AND 3D STITCHING**

Stanley Leong

Waygate Technologies

Abstract

This paper illustrates a promising solution for inspecting internal welds within pipe interiors using a long-steer borescope with advanced image processing and 3D stitching. This approach addresses the challenges of visual inspection in smaller diameter below 5 inches, and, low-light environments, particularly for applications in assets such as boiler tubing and header, cleanroom pipes, and chemical plant and refinery flanged pipeline. Limitations of Traditional Methods: 1) Limited Accessibility: Traditional methods like phased array UT probes and Robotic Crawlers may struggle to reach the entire weld zone due to physical limitations, especially in tight spaces with bends or elbows. Disassembly for full access can be time-consuming and expensive. 2) Visualization Challenges: while PTZ and pushrod camera addresses some flexibility, their data acquisition capabilities may not provide the necessary detail for a comprehensive weld assessment. Firstly, the long reach of the borescope overcomes accessibility challenges, while a suitable centralizer (not covered in detail here) ensures proper probe alignment within the pipe. Secondly, borescope with advanced image processing suite addresses common issues encountered in low-light or unevenly lit environments. It incorporates three key functionalities: 1) Noise Reduction: This technique averages multiple consecutive frames while momentarily holding the live image, minimizing noise and improving image clarity, 2) DarkBoost: This real-time optical bonding technique with gamma correction enhances image quality in low-light conditions or overexposed areas, 3) High Dynamic Range (HDR) Processing: This method combines five pictures captured with varying exposure levels during freeze-frame acquisition. Further processing refines details in underlit corners and bloom areas, facilitating corrosion detection and highlighting weld irregularities, 4) 3D Point Cloud Visualization: Following image capture, the borescope stitches together up to 10 individual pictures to create a comprehensive 3D point cloud visualization of a full 360° orbital weld spanning 4 up to 8 inches. This approach is particularly suited for pipes with diameters ranging from 1 to 3.5 inches. For larger pipes, the process must then be repeated in multiple sections for complete weld analysis. These software suites enhanced visualization capability empowers inspectors to confidently measure various weld parameters along extended sections, including the highest and lowest points, mismatch, and angle of entry. Analyzing a larger weld segment significantly improves the reliability and comprehensiveness of the inspection. Future Developments and Challenges remains, two main areas are, 1) Maintaining Probe Centrality: Maintaining probe centrality after navigating multiple elbows within the pipe is crucial for accurate data acquisition. While not explicitly covered in this abstract, the use of a centralizer to maintain probe alignment within the pipe is essential for accurate data acquisition, 2) Borescope 3dloc/Marking System: Additionally, implementing a borescope-based marking system for orbital welds could further enhance measurement repeatability, enabling the monitoring of factors like erosion and stress-induced corrosion over time. Addressing these challenges will refine the technique for even greater effectiveness in real-world NDT applications.

Keywords : video borescope, remote visual inspection, 3D Measurement, Advanced Image Processing, 3D Stitching, 3D Point Cloud Visualization

PAPER 20B**NEW WAY OF WORKING FOR VISUAL INSPECTION ANALYSIS THROUGH UTILIZATION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

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Wan Abdullah B Wan Hamat

Petroliam Nasional Berhad (PETRONAS)

Abstract

Visual inspection is a critical component of maintaining equipment integrity in the oil and gas industry. Visual inspection is the initial step of conducting an inspection which involves a detailed and systematic examination of equipment to detect any signs of anomaly, damage, corrosion, or other issues before any other examination such as Non-Destructive Examination (NDE) or assessment to be conducted. This method produces large amount of unstructured data leading to delay in detailed findings analysis, inconsistent evaluation which resulting asset integrity issues such as leak, fire, or incident. The manual and laborious findings analysis can be improved through utilization of Artificial Intelligence (AI) and Machine Learning (ML) technologies. This paper will share the development of AI model by PETRONAS which able to detect and categorize external corrosion severity accordance to ISO4628-3 (2016): Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance —Part 3: Assessment of degree of rusting. The AI model is trained and developed using thousands of actual external corrosion photos from PETRONAS operating plants in Malaysia and the model able to obtain accuracy of more than 85% for corrosion detection and rust grade identification. By utilizing this AI model, analysis of external visual inspection findings can be conducted in timely manner without jeopardizing the accuracy of analysis. This solution, currently applicable only to external corrosion analysis, is promising for revolutionizing visual inspection management. By leveraging Artificial Intelligence and Machine Learning, it opens up possibilities for addressing other use cases, such as internal corrosion, Corrosion Under Insulation (CUI), and Infrared Thermography, transforming the current approach to visual inspection management.

Keywords : Artificial Intelligence (AI), Machine Learning (ML), Non-Destructive Examination (NDE), Visual Inspection



7TH MINDTCE
7TH MALAYSIA INTERNATIONAL NDT CONFERENCE AND EXHIBITION