ICETI 2026

BOOK OF ABSTRACTS

OCTOBER 14-18 2026

10TH INTERNATIONAL CONFERENCE ON ENGINEERING TECHNOLOGY AND INNOVATION

WWW.ICETI.ORG



10th INTERNATIONAL CONFERENCE ON ENGINEERING TECHNOLOGY AND INNOVATION (ICETI)

ISBN 978-605-67955-8-9

BOOK OF ABSTRACTS OF THE 10th INTERNATIONAL CONFERENCE ON ENGINEERING TECHNOLOGY AND INNOVATION (ICETI)

OCTOBER 14 TO 18, 2026 IN SARAJEVO, BOSNIA AND HERZEGOVINA

Edited by

Prof. Dr. Özer Çınar

Published, 2026

info@iceti.org
www.iceti.org
This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned. Nothing from this publication may be translated, reproduced, stored in a computerized system or published in any form or in any manner, including, but not limited to electronic, mechanical, reprographic or photographic, without prior written permission from the publisher. The individual contributions in this publication and any liabilities arising from them remain the responsibility of the authors. The publisher is not responsible for possible damages, which could be a result of content derived from this publication.

SCIENTIFIC COMMITTEE

NAME	INSTITUTION	COUNTRY
Prof. Dr. Adisa Parić	University of Sarajevo	BiH
Prof. Dr. Aleksandar Dimitrov	Ss. Cyril and Methodius University	N. Macedonia
Prof. Dr. Anita Grozdanov	Ss. Cyril and Methodius University	N. Macedonia
Prof. Dr. Asif Šabanović	International University of Sarajevo	BiH
Prof. Dr. Christos Douligeris	University of Erlangen-Nürnberg	Germany
Prof. Dr. Dragutin T. Mihailović	University of Novi Sad	Serbia
Prof. Dr. Erkan Şahinkaya	İstanbul Medeniyet University	Türkiye
Prof. Dr. Falko Dressler	University of Paderborn	Germany
Prof. Dr. Houssam Toutanji	Western Michigan University	USA
Prof. Dr. Ian F. Akyıldız	Georgia Institute of Technology	USA
Prof. Dr. İsmail Usta	Marmara University	Türkiye
Prof. Dr. Liljana Gavrilovska	Ss. Cyril and Methodius University	N. Macedonia
Prof. Dr. Lukman Thalib	Qatar University	Qatar
Prof. Dr. M. Asghar Fazel	University of Environment	Iran
Prof. Dr. Mehmet Akalin	Marmara University	Türkiye
Prof. Dr. Mehmet Kitiş	Süleyman Demirel University	Türkiye
Prof. Dr. Muammer Koç	Hamad bin Khalifa University	Qatar
Prof. Dr. Özer Çınar	Yıldız Technical University	Türkiye
Prof. Dr. Perica Paunovik	Ss. Cyril and Methodius University	N. Macedonia
Prof. Dr. Rifat Škrijelj	University of Sarajevo	BiH
Prof. Dr. Samir Đug	University of Sarajevo	BiH
Prof. Dr. Tanju Karanfil	Clemson University	USA
Prof. Dr. Tibor Biro	National University of Public Service, Budapest	Hungary
Prof. Dr. Umit Alver	Karadeniz Technical University	Türkiye
Prof. Dr. Wolfgang Gerstacker	University of Erlangen-Nürnberg	Germany
Prof. Dr. Yılmaz Yıldırım	Bülent Ecevit University	Türkiye
Prof. Dr. Yousef Haik	Hamad bin Khalifa University	Qatar
Assoc. Prof. Dr. Alaa Al Hawari	Qatar University	Qatar
Assoc. Prof. Dr. Izudin Dzafic	International University of Sarajevo	BiH
Assoc. Prof. Dr. Muhamed Hadziabdic	International University of Sarajevo	BiH
Assoc. Prof. Dr. Nusret Drešković	University of Sarajevo	BiH
Assist. Prof. Dr. Faruk Berat Akçeşme	University of Health Sciences	Türkiye
Assist. Prof. Dr. Fouzi Tabet	German Biomass Research Center	Germany
Assist. Prof. Dr. Haris Gavranovic	International University of Sarajevo	BiH
Assist. Prof. Dr. Murat Karakaya	Atılım University	Türkiye
Assist. Prof. Dr. Sasan Rabieh	Shahid Beheshti University	Iran
Assist. Prof. Dr. Ševkija Okerić	University of Sarajevo	BiH
Assist. Prof. Dr. Ivana Plazonić	University of Zagreb	Croatia
Assist. Prof. Dr. J. Amudhavel	VIT Bhopal University	India
Assist. Prof. Dr. Hasan Bora Usluer	Galatasaray University	Türkiye
Dr. Muhammet Uzun	RWTH Aachen University	Germany
Dr. Zsolt Hetesi	National University of Public Service, Budapest	Hungary
Dr. Zsolt T. Németh	National University of Public Service, Budapest	Hungary

ORGANIZATION COMMITTEE

Chairman(s) of the Conference

Prof. Dr. Özer Çınar - Yıldız Technical University

Members of the Committee

Prof. Dr. M. Asghar Fazel - University of Environment

Prof. Dr. Ümit Alver - Karadeniz Technical University

Assoc. Prof. Dr. Agim Mamuti - Mother Teresa University

Assoc. Prof. Dr. Lukman Thalib - Qatar University

Assoc. Prof. Dr. Nusret Drešković - University of Sarajevo

Assist. Prof. Dr. Sasan Rabieh - Shahid Beheshti University

Alma Ligata - Zenith Travel Investment – Europe Congress Sarajevo

Musa Köse - Zenith Travel Investment – Europe Congress Sarajevo

WELCOME TO ICETI 2026

On behalf of the organizing committee, we are pleased to announce that the 10th International Conference on Engineering Technology and Innovation (ICETI-2026) is held in Sarajevo, Bosnia and Herzegovina on October 14–18, 2026 (Hybrid Conference). ICETI 2026 provides an ideal academic platform for researchers to present the latest research findings and describe emerging technologies and directions in Engineering Technology and Innovation. The conference seeks to contribute to presenting novel research results in all aspects of Engineering Technology and Innovation. The conference aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results about all aspects of Engineering Technology and Innovation. It also provides the premier interdisciplinary forum for scientists, engineers and practitioners to present their latest research results, ideas, developments and applications in all areas of Engineering Technology and Innovation. The conference will bring together leading academic scientists, researchers and scholars in the domain of interest from around the world. ICETI 2026 is the oncoming event of the successful conference series focusing on Engineering Technology and Innovation. The conference's goals are to provide a scientific forum for all international prestige scholars around the world and enable the interactive exchange of state-of-the-art knowledge. The conference will focus on evidence-based benefits proven in technology, innovation and engineering experiments.

Best regards,

Prof. Dr. Özer ÇINAR
Chairman of the Conference

CONTENTS

Book of Abstracts · ICETI 2026 · 12 abstracts

NO.	TITLE AND AUTHORS	COUNTRY	PAGE
01	**AI-Based Quality Control in Plastic Injection Molding: A Review of Prediction, Defect Detection and Optimization** *Enes Dündar, Necmi Cemal Özdemir*	Türkiye	1
02	**Computational Pre-Synthesis Validation of a Disulfide-Epoxy/PDMS Self-Healing Composite for Space Structures** *Waleed Aslam, Sobia A. Rakha, Syed Amer Ahsan Gilani*	Pakistan	2
03	**Development of a Disulfide-Modified Epoxy/PDMS Hybrid Composite: Thermal Activation of Intrinsic Self-Healing for Space Applications** *Waleed Aslam, Sobia A. Rakha, Syed Amer Ahsan Gilani, Abeera Sohail*	Pakistan	3
04	**Recovery of Flexural Strength in Self-Healing Composites: A Comprehensive Validation of a Reversible Covalent Network in Structural Composites** *Waleed Aslam, Sobia A. Rakha, Syed Amer Ahsan Gilani, Umar Shaukat*	Pakistan	4
05	**Comparative Study: Influence of PDMS and Disulfide Content on the Chemical and Mechanical Efficiency of Carbon Fiber Composites** *Waleed Aslam, Sobia A. Rakha, Syed Amer Ahsan Gilani, Umar Shaukat*	Pakistan	5
06	**Gamma Radiation Tolerance of Self-Healing CFRP Composites: Comparative Analysis of PDMS-Modified and Conventional Epoxy Matrices Under Low Dose Rate Exposure** *Waleed Aslam, Sobia A. Rakha, Syed Amer Ahsan Gilani, Abeera Sohail*	Pakistan	6
07	**Assessment of Post-Irradiation Healing Efficiency of Disulfide Epoxy/PDMS Hybrid Composites for Satellite Structures** *Waleed Aslam, Sobia A. Rakha, Syed Amer Ahsan Gilani, Umar Shaukat*	Pakistan	7
08	**A Framework for an Internet of Things-Based Post-Harvest Decision Support System for Maize Farmers** *Solomon Adelowo Adepoju, Enesi Femi Aminu, Oluwaseun Adeniyi Ojerinde, Opeyemi Aderiike Abisoye, Ayobami Ekundayo, Rabiu Omeiza Isah, Muhammadu Tajudeen Salaudeen, Uchenna Ugwuoke*	Nigeria	9
09	**Transient 3D CFD Analysis of Squeeze Film Dampers for Different Reynolds Numbers** *Mithat Murat Yalcin, Bahadır Doğan*	Türkiye	10
10	**Classification of Familial and Sporadic Neurogenetic Disease Cases by Using Clinical Symptoms and Machine Learning** *Mürside Değirmenci Akdeniz*	Türkiye	11
11	**Triple Loop Learning for Proactive Anomaly Detection in Relational Databases: Architecture, Evaluation, and MAD-GAN Augmentation** *William Kandolo*	Austria	12
12	**Optimization of Industrial Manufacturing Processes Using Lean Manufacturing and Six Sigma Principles** *Yonas Kelali*	–	13

AI-BASED QUALITY CONTROL IN PLASTIC INJECTION MOLDING: A REVIEW OF PREDICTION, DEFECT DETECTION AND OPTIMIZATION

Enes Dündar[a*], Necmi Cemal Özdemir[a]

[a]Kocaeli University, Türkiye

*245102051@kocaeli.edu.tr

Abstract:

Plastic injection molding is a common manufacturing process in automotive, appliance and consumer product industries. However, product quality may change due to variations in injection pressure, melt temperature, cooling conditions, mold behavior, material properties and operator-dependent visual inspection. For this reason, artificial intelligence has become an important approach for improving quality control in injection molding production lines. This study reviews recent artificial intelligence applications in plastic injection molding with a focus on three industrial problems: quality prediction, visual defect detection and process optimization.

A literature review was conducted by examining studies that use machine learning, deep learning, machine vision, sensor-based monitoring and optimization methods in injection molding. The reviewed studies were grouped according to their data type, algorithm and production objective. The results show that process data such as pressure, temperature, cycle time and cavity sensor signals can be used to predict part quality with machine learning models. Vision-based systems using convolutional neural networks and YOLO-based models are useful for detecting visible defects such as incomplete filling, burn marks, deformation, surface defects and dimensional irregularities. In addition, artificial neural networks, genetic algorithms and explainable artificial intelligence methods can support parameter selection and help identify process variables that affect product quality.

The review indicates that the most practical industrial solution is an integrated quality-control structure combining machine vision, process data, edge computing and automation interfaces. Such a structure can support real-time OK/NG decisions, reduce manual inspection dependency and improve production consistency. However, limited labeled data, lighting changes, part positioning differences and model generalization remain important challenges before full industrial deployment.

Keywords: Plastic Injection Molding, Artificial Intelligence, Quality Prediction, Visual Defect Detection, Process Optimization, Machine Vision

COMPUTATIONAL PRE-SYNTHESIS VALIDATION OF A DISULFIDE-EPOXY/PDMS SELF-HEALING COMPOSITE FOR SPACE STRUCTURES

Waleed Aslam[a*], Sobia A. Rakha[a], Syed Amer Ahsan Gilani[a]

[a]Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), Pakistan

*v.waleedaslam@gmail.com

Abstract:

Self-healing polymers with specific properties continue to be a design challenge because of the multitude of dynamic chemistries and polymer matrices, and a lot of trial and error experimentation is often necessary. To tackle this challenge, a hybrid approach of density functional theory (DFT) and molecular dynamics (MD) is used to qualitatively predict the self-healing capability of disulfide containing polymer composites before synthesis. The main goal is to validate this computational protocol by comparing the theoretical healing efficiencies with the experimental ones reported for five material systems: three polyurethanes with different hard segments (IP, HM, M) and two polymethacrylate networks (BTA and ADSA). Three theoretical parameters are used in the research methodology: (i) the probability of the formation of sulfenyl radicals (ρ) by the dissociation of the S-S bond, calculated using quantum molecular dynamics; (ii) the energetic barrier of the disulfide exchange reaction (ΔG), obtained by transition state calculations; and (iii) chain mobility (ω) obtained by classical molecular dynamics simulations using radial distribution functions. Results show very good qualitative agreement with experimental observations. The IP material has high ρ values and high chain mobility (ω = 0.0613), which is consistent with its 100% healing efficiency, whereas M has negligible radical formation (ρ ≈ 0.0005) and low chain mobility (ω = 0.0361) which explains its lack of self-healing. Likewise, BTA has high radical formation (ρ = 0.2165) and good chain mobility (ω = 0.0506), while ADSA has low chain mobility (ω = 0.0008) and no radical formation, and healing efficiencies up to 85–92% have been reported for BTA. The study demonstrates that the DFT/MD protocol is a reliable pre-synthesis predictive tool for screening promising candidates of self-healing materials, and provides significant programmatic value by shortening development time and costs of experimental screening.

Keywords: Self-healing, Dynamic Chemistry, Disulfides, Polymer Composites, Computational Chemistry

DEVELOPMENT OF A DISULFIDE-MODIFIED EPOXY/PDMS HYBRID COMPOSITE: THERMAL ACTIVATION OF INTRINSIC SELF-HEALING FOR SPACE APPLICATIONS

Waleed Aslam[a*], Sobia A. Rakha[a], Syed Amer Ahsan Gilani[a], Abeera Sohail[a]

[a]Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), Pakistan

*v.waleedaslam@gmail.com

Abstract:

Thermal cycling in orbit is a major factor in the development of microcrack damage in satellite structures, which is a critical limiting factor in their operational lifetime. The development and characterization of a disulfide-modified epoxy-PDMS hybrid composite system solves a basic problem: how to repair autonomously without compromising the structural integrity or adding outgassing hazards. A novel matrix formulation was developed by adding 4-aminophenyl disulfide (AFD) to a diglycidyl ether of bisphenol A (DGEBA) epoxy system, modified with hydroxyl-terminated PDMS at different concentrations (5–15 wt%). APTES was used as a compatibilizer to improve the adhesion between the epoxy and PDMS. The carbon fiber reinforced laminates were produced using a vacuum-assisted resin transfer molding (VARTM) process and a $[0/90]_4$ layup. The thermal activation behavior was investigated by differential scanning calorimetry (DSC) and dynamic mechanical analysis (DMA) to determine the disulfide metathesis kinetics at different temperatures. The healing efficiency was evaluated by measuring the mode I fracture toughness recovery (G-IC) after controlled crack initiation and thermal treatment under vacuum conditions at 3 different temperatures (80°C, 100°C, and 120°C). Space compatibility was verified by outgassing tests (ECSS-Q-ST-70-02C). The disulfide exchange onset was confirmed by DSC at 85°C and maximum metathesis activity at 105°C, which is well within the operational temperature range of typical satellite orbits. The storage modulus retention of DMA at 120°C was 92%, showing minimal thermal softening. The healing efficiency was optimized at 10 wt% PDMS and 8 wt% AFD, with 87% recovery of initial G-IC after 2-hour thermal activation at 100°C, and was found to decay progressively with multiple healing cycles (n=5) due to partial phase separation observed using SEM. Importantly, the total mass loss (TML) was 0.82% and the collected volatile condensable materials (CVCM) was 0.04%, which were both in full compliance with space material standards. This work successfully provides a material with programmatic path to autonomous damage repair in satellite structures with a goal of extending operational life.

Keywords: Self-healing Composite, Disulfide Metathesis, Thermal Activation, Space Structures, Epoxy-PDMS Hybrid, Outgassing Compliance

RECOVERY OF FLEXURAL STRENGTH IN SELF-HEALING COMPOSITES: A COMPREHENSIVE VALIDATION OF A REVERSIBLE COVALENT NETWORK IN STRUCTURAL COMPOSITES

Waleed Aslam[a*], Sobia A. Rakha[a], Syed Amer Ahsan Gilani[a], Umar Shaukat[a]

[a]Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), Pakistan

*v.waleedaslam@gmail.com

Abstract:

This research provides a full experimental validation of the flexural strength recovery of carbon fiber composites with a reversible disulfide covalent network, and provides quantitative performance metrics needed for aerospace structural applications. Carbon fiber/epoxy laminates were fabricated using 4-aminophenyl disulfide (6–10 wt%) as a dynamic cross linker in an amine cured epoxy matrix. The chain mobility was improved by adding PDMS (5 wt%). Controlled damage was applied to the specimens by three-point bending, resulting in micro crack densities of 0.5–2.0 cracks/mm². The activation temperature of healing was 100°C and the activation time was 4 hours with light contact pressure (0.1 MPa). The flexural strength recovery was evaluated by re-testing and healing efficiency (η) was calculated as the ratio between the flexural strength of the healed and original samples. Other characterizations performed were fracture surface analysis using SEM-EDS, dynamic mechanical thermal analysis (DMTA) for crosslink density calculation, and fatigue pre-cracking and healing for damage tolerance restoration. The average flexural strength of undamaged composites was 685 MPa (±32 MPa). After controlled damage, strength decreased to 247 MPa (64% reduction). Specimens were recovered after thermal activation at 589 MPa, which equates to an 86% healing efficiency. The higher the disulfide content (8 wt%), the better the recovery, but the lower the initial modulus (12%). SEM analysis showed that the cracks closed and the matrix re-integrated, with remaining crack widths <2 µm. The fatigue test showed that the healed specimens had 73% of the fatigue life of virgin specimens at 60% of the ultimate load. There was progressive efficiency decay over multiple healing cycles (n=3; 86% → 79% → 68%), which was believed to be due to network reorganization and degradation of the fiber-matrix interface. The reversible crosslink density restoration after healing was confirmed by DMTA, and 91% of the peak characteristics of tan δ were recovered. The recovery of flexural strength demonstrated (86%) and the significant recovery of fatigue life gives programmatic confidence to move this technology to load-bearing satellite components. The trade space found between initial stiffness and healing ability can be used to guide material optimization for particular mission needs.

Keywords: Flexural Strength Recovery, Reversible Covalent Networks, Disulfide Chemistry, Structural Composites, Healing Efficiency

COMPARATIVE STUDY: INFLUENCE OF PDMS AND DISULFIDE CONTENT ON THE CHEMICAL AND MECHANICAL EFFICIENCY OF CARBON FIBER COMPOSITES

05 · MATERIALS & NANO-ENGINEERING

Waleed Aslam[a*], Sobia A. Rakha[a], Syed Amer Ahsan Gilani[a], Umar Shaukat[a]

[a]Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), Pakistan

*v.waleedaslam@gmail.com

Abstract:

his paper provides a systematic comparative study to investigate the effect of PDMS and disulfide content on the chemical healing mechanisms and mechanical performance of carbon fiber reinforced composites, and provides composition-property relationships for material optimization. Nine different composite formulations of epoxy matrix with different disulfide content (4, 8, 12 wt% AFD) and PDMS content (0, 7.5, 15 wt%) were fabricated using a design of experiments (DoE) approach. The efficiency of chemical healing was assessed by the observation of the crack closure by fluorescence microscopy of micro-indented specimens after thermal treatment (100°C, 3 hrs). The mechanical efficiency was evaluated by interlaminar shear strength (ILSS) recovery, short-beam shear testing and Mode I fracture toughness (G-IC) before and after healing. Disulfide bond reformation kinetics were monitored using Fourier-transform infrared spectroscopy (FTIR) and viscosity changes during healing were quantified using rheological characterization. The factors and interactions that significantly influenced healing performance were determined by statistical analysis (ANOVA). FTIR analysis showed reversible disulfide bond cleavage and reformation, with 8 wt% AFD showing optimal exchange kinetics (90% bond recovery in 2 hours). Rheological data showed that the addition of PDMS decreased the viscosity of the matrix by 35–60%, increasing the mobility of the molecules, but at the same time decreasing the modulus at room temperature proportionally. The statistical analysis showed that there was a significant interaction effect between disulfide content and PDMS content ($p<0.01$): high PDMS (15 wt%) and high AFD (12 wt%) led to rapid healing ($\eta=91\%$ at 2 hrs) but poor initial ILSS (38 MPa vs. 62 MPa baseline). On the other hand, 8 wt% AFD with 7.5 wt% PDMS balanced initial performance (58 MPa ILSS) with sustained healing efficiency (84% recovery). The formulations without PDMS had poor crack closure ($\eta<40\%$) even though they were disulfide active, demonstrating the importance of PDMS in allowing crack-face contact. The best composition recovered 87% of G-IC after five healing cycles, and showed 8% degradation in initial modulus relative to the baseline epoxy composites. The optimal formulation identified is used as a validated baseline for aerospace structural applications, with a balance of healing efficiency and structural integrity (58 MPa ILSS).

Keywords: Composition-property Relationships, PDMS Content Optimization, Disulfide Concentration, Healing Efficiency, Interlaminar Shear Strength

GAMMA RADIATION TOLERANCE OF SELF-HEALING CFRP COMPOSITES: COMPARATIVE ANALYSIS OF PDMS-MODIFIED AND CONVENTIONAL EPOXY MATRICES UNDER LOW DOSE RATE EXPOSURE

Waleed Aslam[a*], Sobia A. Rakha[a], Syed Amer Ahsan Gilani[a], Abeera Sohail[a]

[a]Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), Pakistan

*v.waleedaslam@gmail.com

Abstract:

For spacecraft in medium and geosynchronous Earth orbit, the cumulative gamma radiation dose is 5 to 50 krad during a typical mission lifetime. This ionizing radiation induces chain scission, crosslinking and microcracking in carbon fiber reinforced polymer (CFRP) composites in satellite structures.

One important factor in determining the longevity of structural composites in space radiation environments is their survivability. Self-healing composites have the ability to repair damage on their own, but their resistance to radiation during extended low dose rate exposure is not well understood. A comparative study of gamma radiation tolerance of two self-healing CFRP formulations, PDMS modified disulfide-epoxy hybrid and conventional disulfide-epoxy matrix without PDMS, is presented.

The composite laminates were manufactured using VARTM with 8 wt% AFD as the dynamic crosslinker. Two types of matrix variants were fabricated: epoxy-AFD (7.5 wt% PDMS and APTES) and epoxy-AFD (no PDMS). Co-60 gamma irradiation was used to simulate space conditions with a dose rate of 0.08 rad/sec. The total dose levels studied were 5 krad (18 hours) and 10 krad (35 hours) which correspond to 3–5 years in MEO. Post-irradiation characterization consisted of flexural strength retention, DMA for Tg shifts, FTIR for chemical degradation, and SEM for microstructural damage.

Non-PDMS formulations showed significant degradation: flexural strength decreased by 23% after 5 krad and 38% after 10 krad, Tg decreased by 12°C and 19°C, respectively. FTIR showed chain scission and disulfide bond cleavage. PDMS-modified composites exhibited excellent tolerance: flexural strength retention of 94% at 5 krad and 87% at 10 krad with Tg suppression <5°C. SEM confirmed that there were two mechanisms: sacrificial energy dissipation through flexing of the siloxane chains and reduced crosslink density gradients to minimize internal stresses. ANOVA showed that PDMS was the most dominant factor ($p<0.001$).

PDMS modification was found to impart an outstanding gamma radiation tolerance to self-healing CFRP composites, with the formulation of the modified composites showing less than 15% mechanical loss after 10 krad, which is a 2.5× improvement over the conventional matrices. The results confirm the use in radiation prone satellite applications such as geostationary satellites and deep space probes.

Keywords: Gamma Radiation Tolerance, Space Radiation, CFRP Composites, Radiation Hardness

ASSESSMENT OF POST-IRRADIATION HEALING EFFICIENCY OF DISULFIDE EPOXY/PDMS HYBRID COMPOSITES FOR SATELLITE STRUCTURES

07 · MATERIALS & NANO-ENGINEERING

Waleed Aslam[a*], Sobia A. Rakha[a], Syed Amer Ahsan Gilani[a], Umar Shaukat[a]

[a]Pakistan Space and Upper Atmosphere Research Commission (SUPARCO), Pakistan

*v.waleedaslam@gmail.com

Abstract:

3 to 15 years in space, spacecraft in medium and geostationary Earth orbits, accumulate gamma radiation doses of 5 to 50 krad. This ionizing radiation causes degradation of polymer matrix composites by chain scission and crosslinking. Self-healing composites with reversible disulfide chemistry can provide self-repair of microcracks during orbital thermal cycling. The question is whether the healing mechanism survives gamma exposure or not, however.

In space applications, self-healing composites should be able to withstand radiation and remain self-healing after radiation exposure. This paper evaluates the healing efficiency of disulfide-epoxy/PDMS hybrid carbon fiber composites after gamma radiation and quantifies the competition between the damage caused by the gamma radiation and the ability to heal the material through thermal treatment for use in satellite structural applications.

The preparation of the hybrid composites (8 wt% AFD, 7.5 wt% PDMS) and non-PDMS controls were prepared as carbon fiber laminates. Specimens were irradiated with Co-60 gamma rays at 0.08 rad/sec up to a total dose of 5 krad (18 hours) and 10 krad (35 hours). The post-irradiation healing efficiency was assessed by introducing controlled microcracks by three-point bending to 60–70% strength reduction, thermal activation at 100°C for 4 hours under vacuum and re-testing to determine flexural strength and ILSS recovery. The healing efficiency (η) was determined as the ratio of healed/strength. The characterization methods used were FTIR, DMA and XPS.

The healing efficiency of the PDMS modified composites was 87% at baseline. Efficiency was strong at 82% after 5 krad, and 76% after 10 krad (94% and 87% of the baseline efficiency). The recovery of ILSS was similar: 79% post-5 krad and 71% post-10 krad. The efficiency of non-PDMS controls was found to be severely degraded with 5 krad reducing efficiency to 51% and 10 krad to 34%, thus demonstrating the critical role of PDMS. FTIR results indicated that 92% of disulfide bond reformation occurred after 10 krad at 100°C for 2 hours. XPS showed that PDMS reduced the radiation-induced oxidation of sulfur species, maintaining the thiol-disulfide exchange capacity. DMA confirmed that the tan δ characteristics were fully recovered after healing.

Disulfide-epoxy/PDMS hybrid composites still possess significant self-healing properties following space-relevant gamma exposure. The material system has a healing efficiency of >75% after 10 krad, providing programmatic assurance for autonomous damage repair during long satellite missions, and advancing the TRL of the material system to 5–6 for load-bearing satellite structures and deployable components.

Keywords: Post-irradiation Healing, Gamma Radiation, Disulfide Metathesis, Healing Efficiency Retention

A FRAMEWORK FOR AN INTERNET OF THINGS-BASED POST-HARVEST DECISION SUPPORT SYSTEM FOR MAIZE FARMERS

08 · COMPUTER & SOFTWARE & WEB & INFORMATION ENGINEERING

Solomon Adelowo Adepoju[a*], Enesi Femi Aminu[a], Oluwaseun Adeniyi Ojerinde[a], Opeyemi Aderiike Abisoye[a], Ayobami Ekundayo[a], Rabiu Omeiza Isah[a], Muhammadu Tajudeen Salaudeen[a], Uchenna Ugwuoke[a]

[a]Federal University of Technology Minna, Nigeria

*solo.adepoju@futminna.edu.ng

Abstract:

Maize grain which is one of the most viable economic cereals that serves as both food and feed is not immune from post-harvest losses. This is due to temperature, humidity, and carbon dioxide climatic factors thereby leading to food insecurity and huge economic loss to the farmers and other agro-allied stakeholders. Several efforts including traditional storage strategies geared towards mitigating the rate of postharvest loss have not adequately addressed the problem. Recently the use of cutting-edge technologies such as IoT sensors, cloud-based technology, and machine learning models have been employed to develop systems for monitoring and mitigating post-harvest losses for maize. However, some of the systems did not consider the three intertwined climate factors because controlling temperature alone could accelerate the increase of the relative humidity. Other systems do not incorporate a decision support algorithm that will alert farmers and agriculture advisors in real time the climatic condition of the stored grain so as to take an informed decision that will forestall losses. Therefore, this research proposes a framework for a IoT-based post-harvest decision support system for farmers. The proposed system includes generating empirical sensor data of temperature, humidity, and carbon dioxide data from the grain storage locations using the IoT-based sensors and store the collected data in cloud-based data storage (firebase). The raw data can be transmitted to the end users. The proposed framework presents a novel autonomous decision support system that will guide farmers, agricultural advisors, and cooperatives on information to avert maize post-harvest loss.

Keywords: Maize Storage, IoT, Smart Agriculture, DSS

TRANSIENT 3D CFD ANALYSIS OF SQUEEZE FILM DAMPERS FOR DIFFERENT REYNOLDS NUMBERS

09 · MECHANICAL & MANUFACTURING & PROCESS & STRUCTURAL ENGINEERING

Mithat Murat Yalcin[a*], Bahadır Doğan[b]

[a]TUSAŞ Engine Industries (TEI), Türkiye

[b]Eskişehir Osmangazi University, Türkiye

*mmyalcin@gmail.com

Abstract:

Squeeze Film Dampers (SFDs) are crucial damping elements widely used in high-speed turbomachinery to attenuate rotor vibration and enhance system stability. While classical lubrication theory based on the simplified Reynolds equation is commonly applied for SFD performance evaluation, it breaks down in complex 3D geometries and fails to capture significant fluid inertia effects at moderate-to-high speeds. In this study, a three-dimensional, transient Computational Fluid Dynamics (CFD) model is developed using ANSYS Fluent to comprehensively investigate the dynamic behavior of an SFD by solving the full Navier–Stokes equations. The time-dependent kinematic motion and instantaneous velocity boundary conditions of the processing journal are precisely incorporated at each time step via a custom User-Defined Function (UDF). The hydrodynamic pressure distributions on the moving bearing surface are systematically analyzed across various squeeze Reynolds numbers (Re). The numerical results demonstrate that while the classical Reynolds equation provides acceptable approximations at very low Reynolds numbers, fluid inertia effects become increasingly dominant as the Reynolds number exceeds 1 (Re>1), leading to pronounced deviations in peak pressure magnitudes and phase shifts. Furthermore, this study highlights the unique capability of the 3D full Navier–Stokes CFD approach to overcome the geometric and physical simplifications inherent in analytical and Reynolds-based models, providing an accurate and versatile predictive framework for the design of SFDs with complex geometries.

Keywords: Squeeze Film Damper (SFD), Fluid Inertia, Transient CFD, 3D Navier–Stokes, Hydrodynamic Pressure Distribution

CLASSIFICATION OF FAMILIAL AND SPORADIC NEUROGENETIC DISEASE CASES BY USING CLINICAL SYMPTOMS AND MACHINE LEARNING

Mürside Değirmenci Akdeniz[a*]

[a]**Kütahya Health Sciences University, Türkiye**

*mrsddgrmnc.09@gmail.com

Abstract:

Neurofibromatosis type 1 (NF1) is a complex neurogenetic disorder characterized by genetic and neurological features, with clinical manifestations and disease progression that can vary significantly among individuals. This variability in clinical symptoms can complicate the accurate and early detection of the disease and the appropriate classification of patients. This study evaluates the performance of various machine learning methods for detecting NF1 and classifying patients into familial and sporadic cases based on clinical findings. A total of 11 different machine learning algorithms were employed, and their classification performances were compared. Principal Component Analysis (PCA) was applied for the feature selection stage to facilitate more effective evaluation of dataset variables and to achieve dimensionality reduction. The clinical data used in the study were obtained from the UCI Machine Learning Repository. The results indicate that, for the task of detecting NF1, the highest accuracy rate (75.7%) was achieved using Quadratic Discriminant Analysis and Naive Bayes methods on the PCA-processed data. Regarding the classification of familial versus sporadic cases, the Naive Bayes method yielded the highest accuracy rate at 63.5%. These findings demonstrate that machine learning methods represent potential approaches for detecting NF1 based on clinical findings and for classifying cases.

Keywords: Neurofibromatosis Type 1, Machine Learning, Principal Component Analysis, Sporadic Cases, Familial Cases

TRIPLE LOOP LEARNING FOR PROACTIVE ANOMALY DETECTION IN RELATIONAL DATABASES: ARCHITECTURE, EVALUATION, AND MAD-GAN AUGMENTATION

William Kandolo[a*]

[a]**University of Vienna, Austria**

*a09726537@unet.univie.ac.at

Abstract:

Relational database management systems remain critical assets in finance, healthcare, government, cloud services, and industrial information systems. However, many anomaly detection approaches for database security remain static, require frequent retraining, or fail to generalize when query behavior changes. This paper presents a corrected and consolidated camera-ready version of a Triple Loop Learning (TLL) framework for proactive anomaly detection in relational databases. TLL integrates supervised detection, reinforcement-based response adaptation, and meta-learning into a recursive architecture. A multi-agent MAD-GAN-style augmentation module is added to simulate rare, adversarial, and drift-inducing SQL query patterns. The paper strengthens the original formulation by explicitly modeling the interaction among the supervised parameters θ, reinforcement policy parameters ϕ, and meta-learning parameters ψ. It also consolidates the duplicated experimental setup, numbers all equations, distinguishes architectural and mathematical figures, and adds reproducibility details, including query-cluster sampling, reward design, and UNSW-NB15-to-SQL mapping. Evaluation on UNSW-NB15-derived query-pattern tasks and anonymized SQL logs shows that TLL+MAD-GAN improves F1-score, AUC-ROC, and drift robustness over single-loop, double-loop, autoencoder, and MAD-GAN-only baselines. The final discussion adds explainability, computational cost, and deployment-resource considerations for practical use in database security operations.

Keywords: Triple Loop Learning, Relational Databases, Anomaly Detection, SQL Logs, Reinforcement Learning, Meta-learning, MAD-GAN, Generative Adversarial Networks

OPTIMIZATION OF INDUSTRIAL MANUFACTURING PROCESSES USING LEAN MANUFACTURING AND SIX SIGMA PRINCIPLES

Yonas Kelali[a*]

[a]**Independent Researcher**

*yonas.kelali@gmail.com

Abstract:

This study investigates the optimization of industrial manufacturing processes through the integration of Lean Manufacturing and Six Sigma principles. Manufacturing organizations often face challenges such as production delays, excessive waste, defects, process variation, and inefficient resource utilization. The main objective of this study is to identify these inefficiencies and develop a systematic approach for improving productivity, quality, and operational performance. Lean Manufacturing tools, including Value Stream Mapping and 5S, are combined with the Six Sigma DMAIC methodology to analyze process performance and identify the root causes of inefficiencies. The proposed approach focuses on eliminating non-value-added activities, reducing process variation, improving workflow, and controlling production quality. The findings indicate that an integrated Lean Six Sigma approach can support continuous improvement, reduce waste and operational costs, improve product quality, and increase manufacturing efficiency. The study demonstrates that combining Lean Manufacturing with Six Sigma provides a practical framework for organizations seeking sustainable improvements in productivity, quality, resource utilization, and overall manufacturing performance.

Keywords: Lean Manufacturing, Six Sigma, Industrial Engineering, Manufacturing Processes, Process Optimization, Productivity, Quality Improvement

AUTHOR INDEX

20 authors · numbers refer to abstract pages

AUTHOR	PAGE
Abisoye, Opeyemi Aderiike	**9**
Adepoju, Solomon Adelowo	**9**
Akdeniz, Mürside Değirmenci	**11**
Aminu, Enesi Femi	**9**
Aslam, Waleed	**2, 3, 4, 5, 6, 7**
Doğan, Bahadır	**10**
Dündar, Enes	**1**
Ekundayo, Ayobami	**9**
Gilani, Syed Amer Ahsan	**2, 3, 4, 5, 6, 7**
Isah, Rabiu Omeiza	**9**
Kandolo, William	**12**
Kelali, Yonas	**13**
Ojerinde, Oluwaseun Adeniyi	**9**
Rakha, Sobia A.	**2, 3, 4, 5, 6, 7**
Salaudeen, Muhammadu Tajudeen	**9**
Shaukat, Umar	**4, 5, 7**
Sohail, Abeera	**3, 6**
Ugwuoke, Uchenna	**9**
Yalcin, Mithat Murat	**10**
Özdemir, Necmi Cemal	**1**

ICETI

10TH INTERNATIONAL CONFERENCE ON ENGINEERING TECHNOLOGY AND INNOVATION



Western Michigan University

National University of Public Service

International University of Sarajevo IUS

University of Cincinnati

CNR Group