

# DEPARTMENT OF MECHANICAL ENGINEERING



## CENTRE FOR SYSTEM DYNAMICS AND CONDITION MONITORING

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### **About Centre for System dynamics and Condition monitoring:**

The Centre for System Dynamics and Condition Monitoring, established in 2017 with funding from DST and KLEF, is a developing research facility committed to advancing mechanical engineering through research, education, and industry collaboration. The centre is equipped with state-of-the-art systems and focuses on:

- **Damper Testing and Suspension Testing:** Enables studies to analyse variations in damping force with changes in displacement, providing insights into performance optimization.
- **Condition Monitoring Studies:** Focuses on vibration-based and thermography-based diagnostics to assess and improve system reliability. The centre is accessible to research scholars, faculty members of the University, and external organizations for consultancy services. With its advanced tools and ongoing projects, the centre actively contributes to areas such as vibration analysis, thermal imaging, and material testing.

### **Vision**

To be a leading global center of excellence in system dynamics and condition monitoring, known for:

- Pioneering research
- Impactful publications
- Contributions to industry and academia

### **Mission**

To advance mechanical engineering through:

- Innovative research in system dynamics and condition monitoring
- High-quality education and consultancy services
- Development of sustainable engineering solutions



## OBJECTIVES

### ➤ **Research Excellence:**

Conduct cutting-edge research in system dynamics and condition monitoring.

### ➤ **Education and Training:**

Provide top-tier education and training to students and researchers.

### ➤ **Industry Collaboration:**

Foster strong partnerships with industry to apply research findings to real-world problems.

### ➤ **Publication and Dissemination:**

Publish research findings in high-impact journals and conferences.

### ➤ **Consultancy Services:**

Offer expert consultancy services to industry and government organizations.

### ➤ **Innovation and Development:**

Develop new technologies and methodologies in the field of mechanical engineering.



## KEY RESEARCH AREAS

### ► **Vehicle Dynamics**

Study of forces and motions in vehicles, focusing on ride comfort, handling, and stability under various conditions.

### ► **Condition Monitoring**

Continuous tracking of mechanical system health to predict failures and optimize performance using advanced diagnostic techniques.

### ► **System Dynamics**

Analysis of complex mechanical systems' behaviors and interactions to predict their responses under different operating conditions.

### ► **Vibration Analysis**

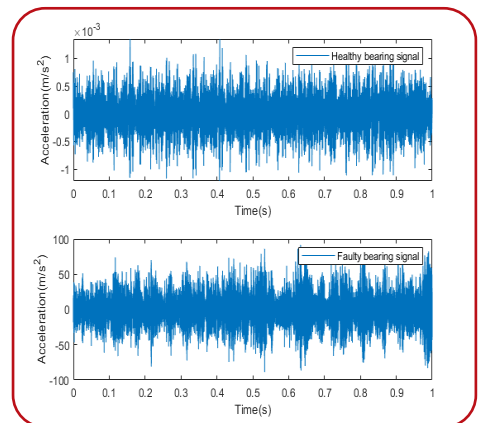
Detection and evaluation of mechanical vibrations to identify potential system failures, ensuring equipment reliability.

### ► **Thermal Imaging**

Use of infrared technology to monitor temperature distributions and detect thermal anomalies in mechanical systems.

### ► **Material Testing**

Evaluation of material properties, such as strength and durability, to ensure their suitability for engineering applications.





## EQUIPMENT DETAILS

Sl.NO	Name of the Equipment	Make
1	Servo Hydraulic Damper Test System (15kN)	BISS (ITW, USA)
2	Suspension Test Rig (25kN)	
	Hydraulic Power Pack (65LPM)	
3	UTM: Nano (25KN)	
4	Vibration Pick-Up (T30Expert)	SPM
5	Thermal Imaging Camera (T420)	FLIR (Sweden)
6	a. CDAQ-9178 (8slot USB) b. NI 9243, 4input, 24 bit c. NI 9220 DSUB, 16 bit,16 Channel d. NI 9237 4 Channel e. NI 9401 8 Channel f. NI 9263 Screwterm 16-bit g. PCB general purpose Accelerometer	National Instruments
7	Rockwell Cum Brinell Hardness Testing Machine	FIE

## EQUIPMENT DETAILS



### Nano Plug and Play Features:

- Single footprint system
- 25 kN load capacity
- $\pm 25$  mm stroke measurement; 0.1  $\mu$ m resolution
- Operating frequency up to 65 Hz
- Virtually noiseless
- High precision servo-control
- Rated for indefinite operation

### Applications

- Tension/Compression/3-point bend
- Ductile and brittle fracture
- Fatigue crack propagation
- Threshold stress intensity
- Low/High-cycle fatigue
- Elastomer

### Servo Hydraulic Test system (Damper Test Rig)

- Force rating: 15kN dynamic capacity
- Actuator stroke: 200 mm
- Peak velocity: 1.5 m/s
- Hydraulic power pack : 65 LPM
- Safety interlocks : Light curtain, pressure sensor
- Grips : Self-aligning top hydraulic grip and bottom pneumatic grip
- Fully automated testing



### Suspension / Quarter Poster Test Rig: Features:

- Simulation of road-load data including displacement, strain, velocity, acceleration, load
- Acceleration upto 5g & Velocity upto 2m/s.

### Applications:

- Ride comfort and road handling tests,
- PSD of road profiles etc.

### FLIR T420, Infrared Thermal Imaging Camera

- Focal Plane Array detector with 320 x 240 pixels IR resolution
- High Thermal Sensitivity (N.E.T.D):  $< 0.045^{\circ}\text{C}$  at  $30^{\circ}\text{C}$
- Temperature range:  $-20^{\circ}\text{C}$  to  $650^{\circ}\text{C}$
- Accuracy:  $\pm 2^{\circ}\text{C}$  or  $\pm 2\%$  of reading
- Measurement modes: Spot (up to 5), Area (up to 5), Isotherm, Hot/Cold, Delta T



## KEY FACULTY MEMBERS



**Dr. DVA RamaSastry, Associate Professor**

Research Area: Vehicle dynamics & Thermal Imaging  
Citations: 112, h-index: 6, i-10 index: 6



**Dr. Surya Narayan Padhi, Professor**

Research Area: Functionally Graded Materials & Characterization  
Citations: 229, h-index: 8, i-10 index: 5



**Dr. G Diwakar, Professor**

Research Area: Condition monitoring and Dynamics  
Citations: 479, h-index: 10, i-10 index: 11



**Dr. P Kasi V Rao, Associate Professor**

Research Area: Characterization of composite materials  
Citations: 169, h-index: 6, i-10 index: 2



**Dr. P Raj Kumar, Assistant Professor**

Research Area: Self-healing polymer composites, Metal foams, FEA of Mechanical components  
Citations: 98, h-index: 7, i-10 index: 5



**Dr. Priyaranjan Samal, Assistant Professor**

Research Area: Composite Materials and Characterization, Wear & Tribology, Advanced Machining  
Citations: 1050, h-index: 16, i-10 index: 21



## OUR COLLABORATORS



**Dr S Sakthinathan**

Department of Material Science Engineering  
National Taipei University of Technology (NTUT)  
Taipei, Taiwan



**Dr. Nathan M. Kathir**

Professor, Department of Mechanical Engineering,  
George Mason University, Burke, Virginia, United States



**Dr. Cheepu Muralimohan,**

Pukyong National University &  
Manager of Welding Research and Development  
STARWELDS Inc., Busan, South Korea



**Dr V Pandu Ranga**

Department of Mechanical Science,  
IIT Bhubaneswar



**Dr Pradeep Dixit**

Department of Mechanical Engineering,  
IIT Bombay



**Dr. Mamilla Ravi Sankar**

Department of Mechanical Engineering,  
IIT Tirupati

## SCHOLARS ASSOCIATED WITH THE CENTRE

### Scholars Completed Ph.D.

S.NO	Name of the Ph. D. research Scholar	Year of Award of PhD
1	Korade Dileep Nana Saheb	2020
2	K. Sirikonda Mallik	2020
3	T. Vijaya Kumar	2020
4	J. Jagadesh Kumar	2020
5	Ratna Deepika Manikonda	2022
6	D. Pratibha	2023
7	M. Venkatesulu	2023
8	Kazi Atik Mubarak	2023
9	Seshu Kumar Gajula	2023
10	Chandrika S	2024
11	Ekta Jain	2024
12	A Sirisha Bhadrakali	2024

### Scholars pursuing Ph.D.

S.No	Name of the Ph.D Research Scholar
1	Asalekar Amol Jagannath
2	Shaikh Azharuddin Kutubuddin
3	Vadlamannati Venkata Krishna Mohan
4	Ch Sirisha
5	Syed Mustaq Ali
6	V Venkata Ramana
7	Mathapati Shivaputra
8	Mulla Moshim Gulab
9	E C Prasad
10	Bankar Priyanka Suresh
11	C Anil Kumar Reddy
12	Purna Surendernath
13	Vadiraj B
14	K. Karthik
15	Manoj Kumar Subrao Kate
16	Burande Chaitanya Girish
17	M Sandeep
18	Vishal Satish Jagadale
19	Kondhalkar Ganesh Eknath
20	Ch Vinay Kumar Reddy
21	Kancharla Bullibabu

## HIGHLIGHTS OF THE RESEARCH CENTRE WORKS- MAJOR ACHIEVEMENTS

### Completed Projects:

Successfully completed two projects worth ₹3.25 lakhs, sponsored by the Department of Science and Technology (DST) and the Naval Research Board (NRB).

### Ongoing Project:

Currently pursuing a project sponsored by the Indian Space Research Organisation (ISRO), valued at ₹12 lakhs.

### PhD:

Supervised the completion of 12 PhDs, with 21 more in progress.

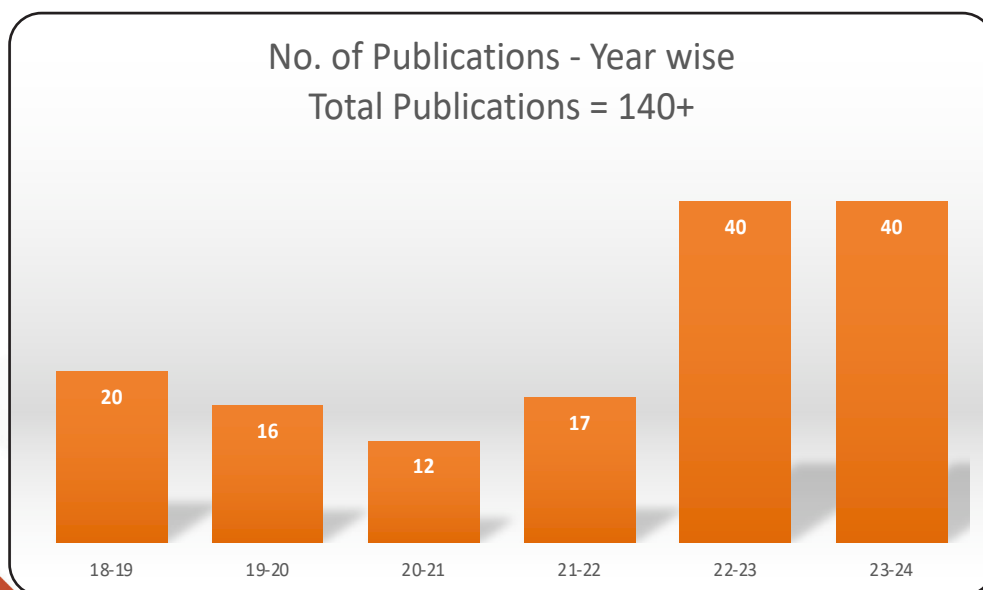
### Publications:

Produced over 140+ publications in reputed Scopus and SCI-indexed journals since the lab's inception.

### Consultancy:

Accomplished consultancy works worth more than ₹10 lakhs.

## PUBLICATIONS





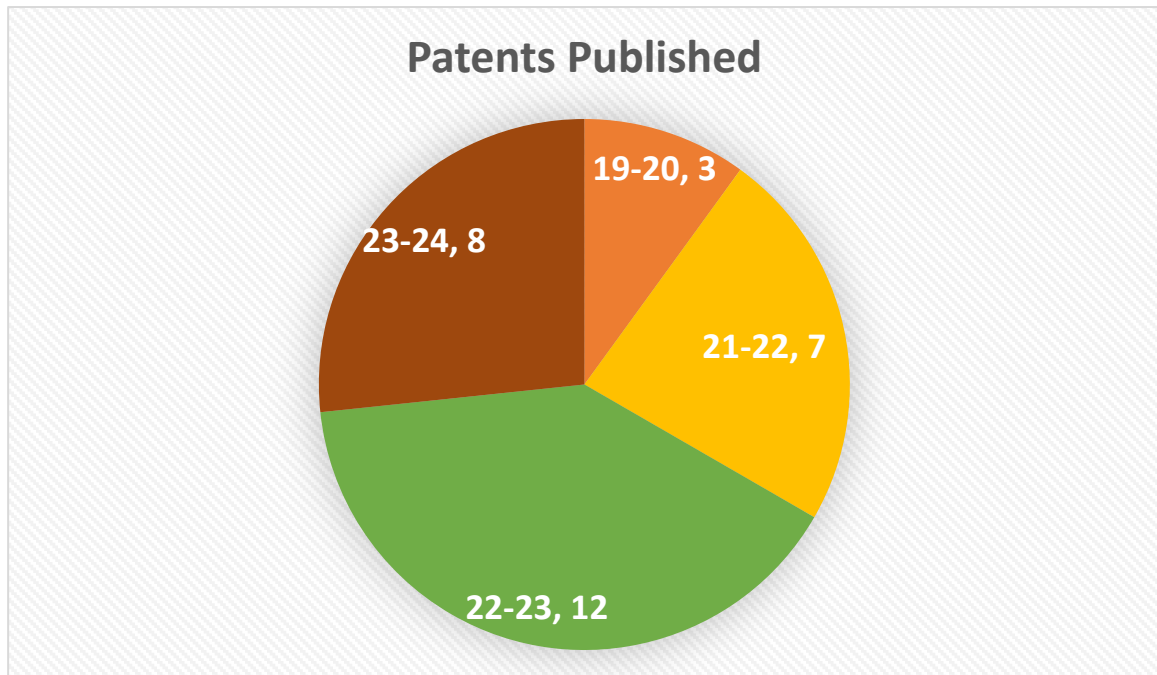
## JOURNAL TITLE OF RECENT PUBLICATIONS

- JOURNAL OF MANUFACTURING PROCESSES (1)
- COMPOSITE STRUCTURES (1)
- CERAMICS INTERNATIONAL (1)
- NDT AND E INTERNATIONAL (1)
- POLYMER COMPOSITES (3)
- JOURNAL OF NATURAL FIBERS (8)
- METALS AND MATERIALS INTERNATIONAL (1)
- POLYMER (1)
- PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS, PART B: JOURNAL OF ENGINEERING MANUFACTURE (1)
- PROCEEDINGS OF THE INSTITUTION OF MECHANICAL ENGINEERS, PART E: JOURNAL OF PROCESS MECHANICAL ENGINEERING (2)
- TRANSACTIONS OF THE INDIAN INSTITUTE OF METALS (2)

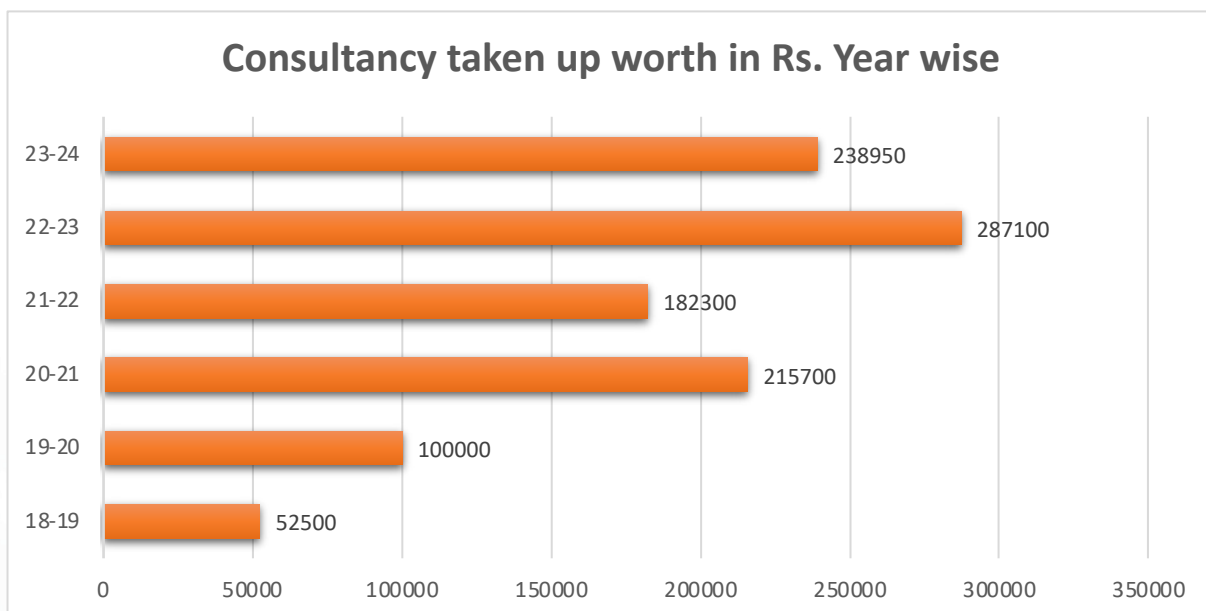
## LIST OF SPONSORED PROJECTS

Sl.No	Title of the Project	Funding Agency	Amount	Status	(PI/Co-PI)
1	Development, Testing and optimization of MRF Dampers	DST	2.96 crores	Completed	Dr K V Ramana – PI DVA Ramasastry – Co-PI
2	Development of a non-stationary thermal wave imaging-based system for quantitative coating thickness evaluation and subsurface anomaly detection	Naval Research Board (NRB)	32 lakhs	Completed	Dr G V Subba Rao – PI Dr. DVA Ramasastry – Co-PI
3	Thermal Imaging of EB Welds	ISRO – LPSC	12 lakhs	In Progress	Dr G V Subba Rao – PI Dr. DVA Ramasastry – Co-PI

**TOTAL PATENTS PUBLISHED: 30**



**DETAILS OF CONSULTANCY/ NGO PROJECTS DONE**



**The total amount from consultancy projects: 10,70,650/-**

## RESEARCH PUBLICATIONS

**Total Publications (Indexed in SCOPUS/WoS) : 140 +**

### Major International Journal Publications:

Authors	Title	Year	Source title	Volume	Issue
Bhadrakali A.S.; Sastry D.V.A.R.; Ramprabhu T.	Analysis of SS308L Wire Arc Additive Manufactured Specimen Reinforced with Al <sub>2</sub> O <sub>3</sub>	2024	International Journal of Vehicle Structures and Systems	16	1
Kazi A.M.; Ramasastry D.V.A.; Waddar S.; Mane S.G.	Characterization of Lignocellulosic Roselle Fibre Epoxy Composites for Lightweight Structures	2024	Transactions of the Indian Institute of Metals	77	7
Asalekar A.J.; Rama Sastry D.V.A.	Enhancing high-speed CNC milling performance of Ti6Al4V alloy through the application of ZnO-Ag hybrid nanofluids	2024	Engineering Research Express	6	2
Samal P.; Raj H.; Meher A.; Surekha B.; Vundavilli P.R.; Sharma P.	Synergistic Effect of B <sub>4</sub> C and Multi-Walled CNT on Enhancing the Tribological Performance of Aluminum A383 Hybrid Composites	2024	Lubricants	12	6
Nayak S.; Mohapatra J.; Muduli K.; Khuntia S.K.; Malla C.; Patra S.K.; Nayak B.B.; Samal P.; Swain S.; Jena P.K.	Mechanical and thermal properties of Careya arborea bast fiber-reinforced chitosan composites for packaging industries	2024	Biomass Conversion and Biorefinery	14	17



## RESEARCH PUBLICATIONS

Authors	Title	Year	Source title	Volume	Issue
Samal P.; Khadanga K.C.; Surekha B.; Vundavilli P.R.	Parametric modeling of resin-bonded sand mold systems using machine learning-based approaches	2024	Engineering Research Express	6	3
Raviteja T.; Surekha B.; Samal P.; Sharma N.	Effect of diffusion of elements on microstructural, mechanical, and machining characteristics of Al7075/ZnAl4 functionally graded material with and without Ag and Pb interface	2024	Journal of Alloys and Metallurgical Systems	7	
Pittala R.K.; Sharma P.; Anne G.; Arab J.; Unune D.R.; Kumar C.S.; Fernandes F.	Synthesis and characterization of open cell Ni-Cr foam developed using Pulse electro deposition technique for filtration applications	2024	Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture		
Tadepalli R.K.; Sastry D.V.A.R.; Rao K.N.; Rao C.S.P.	Comparison of Control Strategies in the Design of Semi-Active Secondary Suspension of a Railway Wagon	2023	International Journal of Vehicle Structures and Systems	15	6
Ainapurapu S.B.; Devulapalli V.A.R.; Theagarajan R.P.	Experimental investigation and process parameter optimization in cold metal transfer welding for SS304L using response surface method	2023	Engineering Research Express	5	1

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Authors	Title	Year	Source title	Volume	Issue
Ainapurapu S.B.; Devulapalli V.A.R.; Theagarajan R.P.; Chigilipalli B.K.; Kottala R.K.; Cheepu M.	Microstructure and Mechanical Properties of the Bimetallic Wire Arc Additively Manufactured Structure (BAMS) of SS304L and SS308L Fabricated by Hybrid Manufacturing Process	2023	Transactions of the Indian Institute of Metals	76	2
Vesala G.T.; Ghali V.S.; Rama Sastry D.V.A.; Naik R.B.	Thermal Wave Mode Decomposition for Defect Detection in Non-Stationary Thermal Wave Imaging	2023	Mapan - Journal of Metrology Society of India	38	1
Bhadrakali A.S.; Sastry D.V.A.R.; Chigilipalli B.K.; Naik K.S.; Kakaravada T.I.; Acharya A.; Kumar K.L.	Effect of heat input on microstructure and mechanical properties of bimetallic wire arc additive manufacturing of SS304L and ER308L prepared by hybrid manufacturing process	2023	International Journal on Interactive Design and Manufacturing		
Ramasasthy D.V.A.; Ramana K.V.; Rao N.M.	Performance Analysis of a Half-car Suspension System of a Road Vehicle with Magnetorheological Damper	2023	International Journal of Vehicle Structures and Systems	15	6
Bhadrakali A.S.; Rama Sastry D.V.A.; Prabhu T.R.	A hybrid approach consisting of multi-objective and multivariate analyses for WAAM specimens	2023	Engineering Research Express	5	2
Asalekar A.J.; Rama Sastry D.V.A.; Sreekara Reddy M.B.S.; Barewar S.D.	Analysis of thermophysical properties of novel hybrid nanoparticles based vegetable nanofluid	2023	Journal of Thermal Engineering	9	6

## RESEARCH PUBLICATIONS

Authors	Title	Year	Source title	Volume	Issue
Samal P.; Tarai H.; Meher A.; Surekha B.; Vundavilli P.R.	Effect of SiC and WC Reinforcements on Microstructural and Mechanical Characteristics of Copper Al-loy-Based Metal Matrix Composites Using Stir Casting Route	2023	Applied Sciences (Switzerland)	13	3
Surekha B.; Mahapatra M.M.; Samal P.	Characterization of AZ91D/Al7075 FGMs fabricated through gravity casting: effect of Zn interface	2023	Materials Research Innovations	27	4
Sonika; Verma S.K.; Sharma G.; Nayak R.; Meher A.; Samal P.; Sharma A.	Nanocomposite of intrinsically conductive polymers used as the active component in acetone solvent sensors	2023	Nanotechnology for Environmental Engineering	8	2
Nayak S.; Samal P.; Malla C.; Pradhan M.K.; Khuntia S.K.; Mohapatra J.; Jena P.K.; Patra S.K.; Nayak B.B.; Swain S.	Enhancement of Mechanical, Thermal and Morphological Properties of Eleusine Indica Grass Fiber Reinforced Epoxy Composites	2023	Journal of Natural Fibers	20	1
Sahu S.B.B.P.J.; Nayak S.; Sahu S.; Mohapatra J.; Khuntia S.K.; Sahoo P.K.; Samal P.; Patra S.K.; Swain S.; Nayak B.B.	Extraction and Characterization of Natural CASCABELA Thevetia Bast Fibers: A Potential Candidate as Reinforcement in Epoxy Composites	2023	Journal of Natural Fibers	20	2



## RESEARCH PUBLICATIONS

Authors	Title	Year	Source title	Volume	Issue
Samal P.; Vundavilli P.R.	Dry Sliding Wear Performances of AA5052 Hybrid Composite Brake Disc Materials Reinforced With In Situ Synthesized TiC and Multi-Walled Carbon Nanotube	2023	Journal of Tribology	145	10
Thanikodi S.; Kumar I.; Meena M.; Hemalatha E.; Padhi S.N.; Ouladsmane M.; Abdelgawad H.	Mechanical property analysis of carbon-bamboo fiber-reinforced montmorillonite nanocomposite	2023	International Journal of Advanced Manufacturing Technology		
Vinayaka N.; Christy K.G.J.; Shreepad S.; Padhi S.N.; Damhare S.G.; Puse R.K.; Gayathri K.; Kolekar A.B.; Nagarajan S.	Tribological Behavior on Stir-Casted Metal Matrix Composites of Al8011 and Nano Boron Carbide Particles	2023	Journal of Nanomaterials	2023	
Eknath K.G.; Diwakar G.	Prediction of Remaining useful life of Rolling Bearing using Hybrid DCNN-BiGRU Model	2023	Journal of Vibration Engineering and Technologies	11	3
Kazi A.M.; DVA R.	Characterization of continuous Hibiscus sabdariffa fibre reinforced epoxy composites	2022	Polymers and Polymer Composites	30	
Vesala G.T.; Srinivasarao G.; Ghali V.S.; Sastry D.V.A.R.; Naik R.B.	Non-Stationary Thermal Wave Mode Decomposition: A Comparative Study of EMD, HVD, and VMD for Defect Detection	2022	Russian Journal of Nondestructive Testing	58	6

## RESEARCH PUBLICATIONS

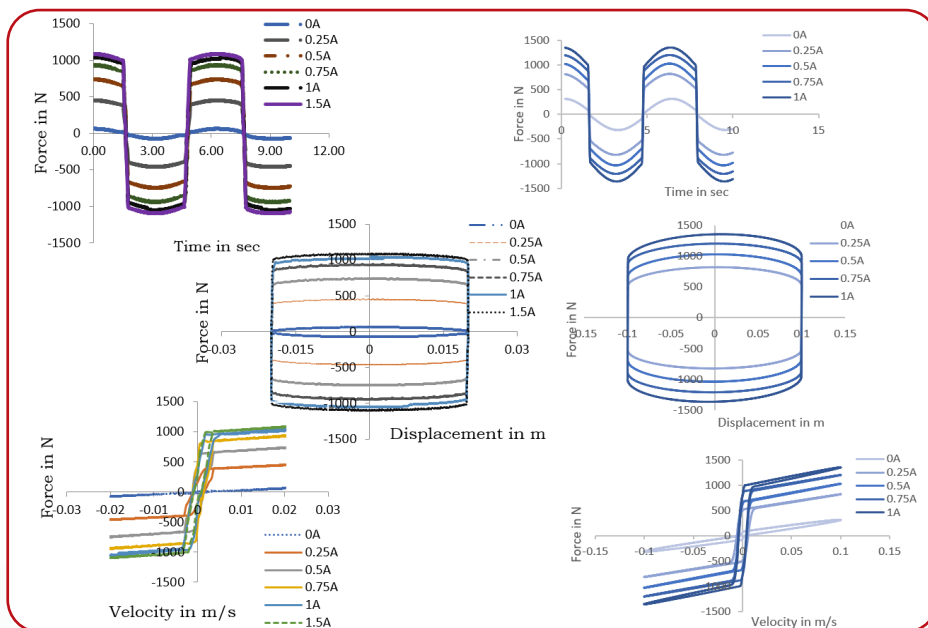
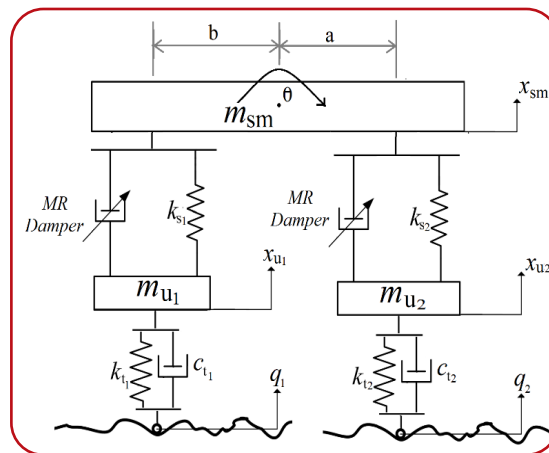
Authors	Title	Year	Source title	Volume	Issue
Kazi A.M.; D. V. A. R.; Waddar S.	Characterization of interwoven roselle/sisal fiber reinforced epoxy composites	2022	Polymer Composites	43	3
Vesala G.T.; Ghali V.S.; Sastry D.V.A.R.; Naik R.B.	Deep anomaly detection model for composite inspection in quadratic frequency modulated thermal wave imaging	2022	NDT and E International	132	
Meher A.; Mahapatra M.M.; Samal P.; Vundavilli P.R.; Shankar K.V.	Statistical Modeling of the Machinability of an In-Situ Synthesized RZ5/TiB2 Magnesium Matrix Composite in Dry Turning Condition	2022	Crystals	12	10
Meher A.; Mahapatra M.M.; Samal P.; Vundavilli P.R.	A review on manufacturability of magnesium matrix composites: Processing, tribology, joining, and machining	2022	CIRP Journal of Manufacturing Science and Technology	39	
Kumar Pittala R.; Dhanaraju G.; Satish Ben B.; Avinash Ben B.	Self-healing of matrix cracking and delamination damage assessment in microcapsules reinforced carbon fibre epoxy composite under flexural loading	2022	Composite Structures	291	

## RESEARCH PUBLICATIONS

Authors	Title	Year	Source title	Volume	Issue
Dhanaraju G.; Satish Ben B.; Pittala R.K.	Thermally remendable bismaleimide-MWCNT/DA-epoxy nanocomposite via Diels-Alder bonding	2022	Polymer	245	
Pittala R.K.; Dhanaraju G.; Beera S.B.; Beera A.B.	Damping behaviour and self-healing performance evaluation of microcapsules reinforced epoxy composites by impulse excitation technique	2022	Journal of Reinforced Plastics and Composites	41	21-22
Kazi A.M.; Devika D.; Waddar S.; D. V. A. R.	Characterization of Roselle fiber composites for low load bearing structures	2021	Polymer Composites	42	5
Wagle C.; Padhi S.N.	Design and analysis of footplate using composite material for partial foot amputation	2021	Trends in Biomaterials and Artificial Organs	35	3
Korade D.; Ramana K.V.; Jagtap K.	Wear and Fatigue Behaviour of Deep Cryogenically Treated H21 Tool Steel	2020	Transactions of the Indian Institute of Metals	73	4
Rama Sastry D.V.A.; Ramana K.V.; Mohan Rao N.	Analysis and prediction of performance of mr damper at different currents and control strategies for quarter suspension system of a roadway vehicle	2019	International Journal of Vehicle Structures and Systems	11	1

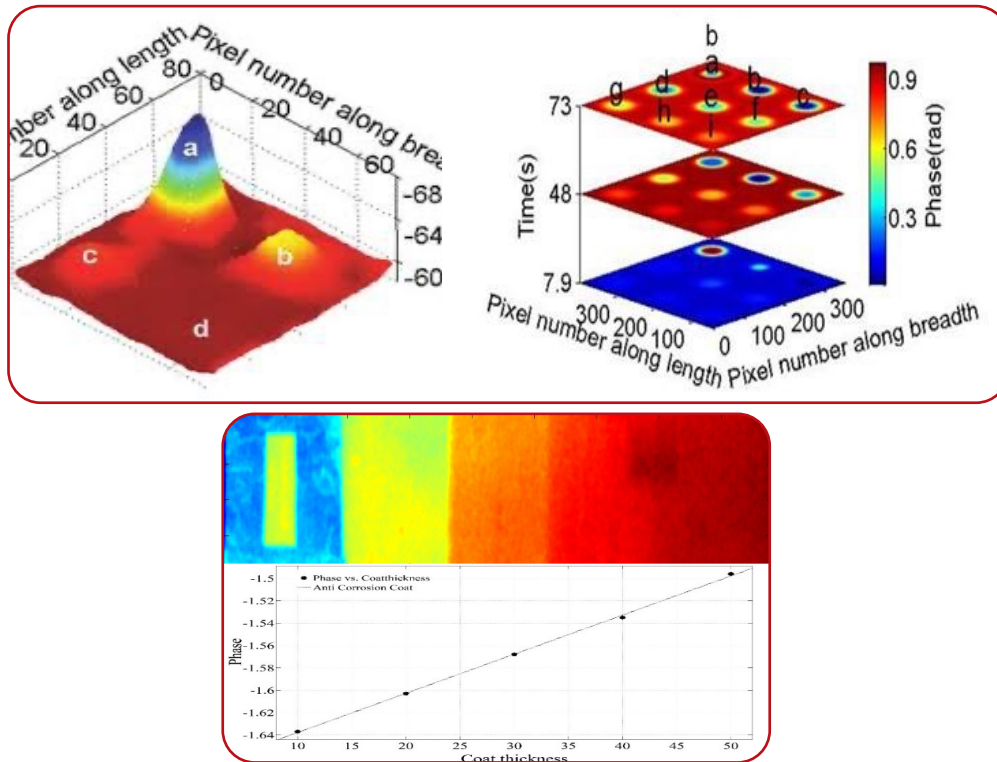
## MAJOR RESEARCH OUTCOMES

Analysis for ride comfort of a suspension system using MR damper under project Development, Testing and Optimization of MRF dampers.



## MAJOR RESEARCH OUTCOMES

Development of a non-stationary thermal wave imaging-based system for quantitative coating thickness evaluation and subsurface anomaly detection. (In collaboration with Infrared Imaging Center, KLEF) Conclusion



## CONCLUSION

Development of a non-stationary thermal wave imaging-based system for quantitative coating thickness evaluation and subsurface anomaly detection. (In collaboration with Infrared Imaging Center, KLEF) Conclusion

Dedicated to producing meaningful outcomes, the centre is steadily building its capabilities to enhance academic knowledge and foster practical applications in engineering and strives for

- » Leading research and consultancy in mechanical engineering
- » Key contributions to industry, academia, and technology development
- » Continuously advancing in system dynamics and condition monitoring



## FOR MORE INFORMATION

### CENTRE INCHARGE

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KL ACCREDITED BY  
NAAC WITH A++  
GRADE  
CATEGORY 1  
UNIVERSITY  
BY MHRD, Govt. of India

nirf NATIONAL  
INSTITUTIONAL  
RANKING  
FRAMEWORK  
2024  
RANKED 22  
AMONG ALL  
UNIVERSITIES  
44 YEARS OF  
EDUCATIONAL  
LEADERSHIP