



DEPARTMENT OF MECHANICAL ENGINEERING

One Week online Faculty Development Programme on

“AI/ML Tools for Advanced Materials Manufacturing and Thermal Systems”ATAMMTS-2024

24th June 2024 - 28th June 2024 ; Timings 9.30AM to 12.30AM.

The one week online Faculty program was conducted through Microsoft Teams Platform. The registrations for the online FDP was opened on 12-06-2024 at 9.30am and closed on 21-06-2024 at 12.00pm. There was a good response from the faculty and research scholars and a total 364 registrations from the participants across the country and overseas. There was 1 participant each from USA and Ethiopia countries. The total number of participants were limited to 250 members in Microsoft Teams after short listing process is done based on first cum first serve.

Registration link: <https://forms.gle/vKBY3NYxJNFQK8z86>

Registration Fee: Free

Registration Deadline: 21-06-2024

Details of Resource Persons:

DEPARTMENT OF MECHANICAL ENGINEERING

One Week online Faculty Development Programme on

“AI/ML Tools for Advanced Materials Manufacturing and Thermal Systems”ATAMMTS-2024

24th June 2024 - 28th June 2024 ; Timings 9.30AM to 12.30AM.

| Name of the Resource Person | Designation and Institute |
|-------------------------------|--|
| Dr. P.Karthik | Research Engineer Buildings Energy Department Florida Solar Energy Center Florida Central university, Florida USA |
| Dr.Murali Mohan Cheepu | Research Professor, Busan, South Korea |

**Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
Department_Report of Online FDP organized from 24-06-2024 to 28-06-2024**

| | |
|-------------------------------|--|
| Dr.D.Chakradhar | Associate Professor Department of Mechanical Engineering Indian Institute of Technology, Palakkad |
| Dr. T.Srinivas | Professor&Head Department of Mechanical Engineering National Institute of Technology, Jalandhar |
| Dr. P.Thirumal | Professor and Head Department of Mechanical Engineering Government College of Engineering, Bargur, Tamilnadu |
| Dr. Rajesh Baby | Associate Professor and Dean Research Department of Mechanical Engineering St.Joseph's College of Engineering and technology, Palai, Kerala |
| Dr. L.Suvarana Raju | Professor Department of Mechanical Engineering NITTTR Bhopal |
| Dr. T.Babu Rao | Assistant Professor & HoD Department of Mechanical Engineering National Institute of Technology Tadepalligudem, A.P. |
| Dr. G.Srinivasu | Assistant Professor Department of Mechanical Engineering National Institute of Technology, Raipur |
| Dr. P.Praveen Kumar | Associate Professor Department of Mechanical Engineering Karunya University, Coimbatore |
| Dr.Chandan Kumar | Assistant Professor Department of Mechanical Engineering SRM University, Amaravathi |
| Dr. M.Subba Rao | Assistant Professor Department of Mechanical Engineering SR University, Warangal |
| Dr. Priyaranjan Sharma | Associate Professor Department of Mechanical Engineering KLU, Vaddeswaram |

Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
Department Report of Online FDP organized from 24-06-2024 to 28-06-2024

Inauguration Function: The inauguration function of the FDP started on 24-06-2024 at 9.30AM, with the welcome address by the Convener, Dr.M.B.S.S.Reddy, Professor & HoD, Department of Mechanical Engineering followed by the key note address by the distinguished guest and resource person, Dr.T.Srinivas, Professor & HoD, Department of Mechanical Engineering, National Institute of Technology, Jalandhar. The inaugural function concluded at 9.50AM. The session on day-1 started with Dr.T.Srinivas on App designer for modeling and simulation of thermal systems. Total 15 sessions conducted in the one week FDP and the details are as given below.

Table 1: Details of Resource Persons and topic delivered

| Date(s) | Name of the Resource Person | & Topic Delivered |
|----------------|---|--|
| 2 4.6.2024 | Dr. T.Srinivas, NIT Jalandhar, National Institute of Technology, Jalandhar. | Topic Delivered: APP Designer for modelind and simulation of thermal systems |
| 2 4.6.2024 | Dr.M.Subba Rao, SR University, Warangal | Topic Delivered: Emerging trends and innovation in tribology |
| 2 4.6.2024 | Dr.K.Venkat Rao, Vignan University, Guntur | Topic Delivered: Online modeling and monitoring of wall geometry in metal based additive manufacturing. |
| 2 5.6.2024 | Dr. T.Babu Rao, NIT Tadepalligudem, A.P | Topic Delivered: Sensor techniques and DAQ for real time monitoring of metal additive manufacturing. |
| 2 5.6.2024 | Dr. A.Manmadha Chary, ICFAI University, Hyderabad | Topic Delivered: Thermal analysis of powder bed fusion additive manufacturing. |
| 2 5.6.2024 | Dr.L.Suvarna Raju, Professor, NITTTR, Bhopal | Topic Delivered: Application of ultrasonic vibrations in friction stir welding process. |
| 2 6.6.2024 | Dr.G.Srinivasu, Asst.Professor, NIT Raipur | Topic Delivered: Machine Learning in material science |
| 2 6.6.2024 | Dr.Murali Mohan Cheepu, Research Professor, Pukyong University, Busan , South Korea | |

**Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
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| | |
|---------------|--|
| | Topic Delivered: Range of AI/ML use in manufacturing and the future of energy fusion&plasma(Artificial Sun) |
| 2 7.6.2024 | Dr.Priyaranjan Sharma, Associate Professor, KLEF, Guntur Delivered: Advanced machining process Wire EDM(Principle, Advantages&Applications, Future challenges and role of AI/ML) |
| 2 7.6.2024 | Dr.Rajesh Baby, Dean-Research, SJ CET, Palai, Kerala Topic Delivered: Thermal system optimization using ANN –Genetic Algorithm approach. |
| 2 7.6.2024 | Dr.Chandan Kumar, Assistant Professor, SRM University, Amaravathi Topic Delivered: Advanced Laser Machining |
| 2 7.6.2024 | Dr.P.Karthik, Research Engineer, Florida Solar Energy Center, Florida, USA Topic Delivered: Basics od Datamining - Machine Learning with building energy systems as example. |
| 2 7.6.2024 | Dr.D.Chakradhar, Associate Professor, IIT, Palakkad Topic Delivered: Artificial Intelligence/Neural networks for optimization of manufacturing systems |
| 2 8.6.2024 | Dr.P.Praveen Kumar, Associate Professor, Karunya University, Coimbatore Topic Delivered: Surface development of Aluminium alloys and composites by advanced surface modification technologies. |
| 2 8.6.2024 | Dr.P.Thirumal Professor, GEC, Bargur, Tamilnadu Delivered: Application of Fuzzy/Neural networks for internal air quality in Air-conditioning |
| 2 8.6.2024 | Dr.M.Krishna Kishore, Asst.Professor, SVNIT, Surat Topic Delivered: Aerodynamics of an Electric vehicle |

Outline of the topics covered in FDP

App Designer for modeling and simulation of thermal systems software was useful for designing any laboratory for the easy to understand type of features for the student community.

Emerging trends and innovation in tribology- different coating materials used for enhancing the heat removal in a particular manufacturing process.

**Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
Department Report of Online FDP organized from 24-06-2024 to 28-06-2024**

The importance of modeling, simulation, analysis and optimization using RSM in solving the complex engineering problems. Online modeling and monitoring of wall geometry in metal based additive manufacturing.

Sensor techniques and DAQ for real time monitoring of metal additive manufacturing.

Thermal analysis of powder bed fusion additive manufacturing.

Application of ultrasonic vibrations in friction stir welding process.

Advanced laser machining-advantages , applications

Advanced machining using Wire EDM

Thermal system optimization using artificial neural network(ANN) - Genetic Algorithm approach.

Machine Learning in material science

Surface development of Aluminium alloys and composites by advanced surface modification technologies.

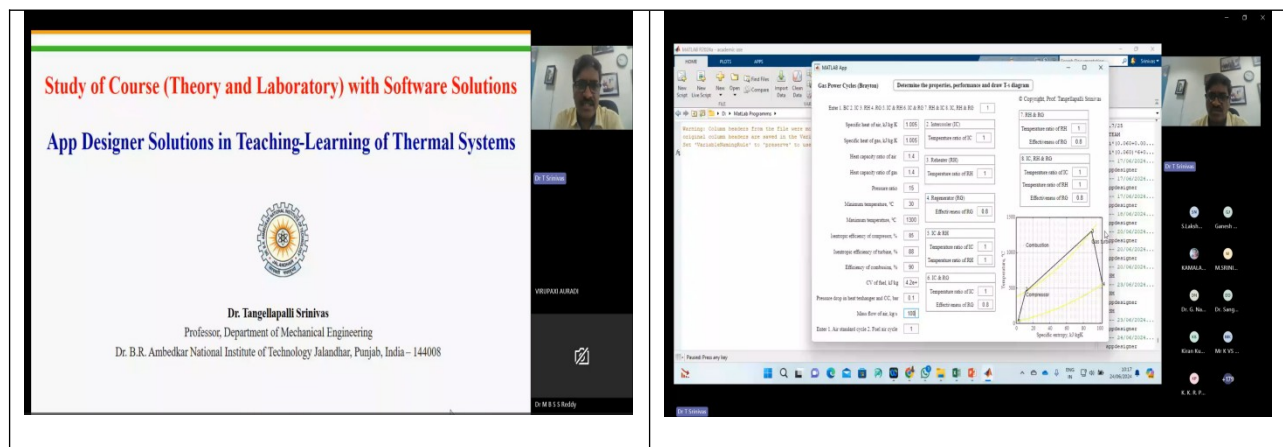
Application of Fuzzy/Neural networks for internal air quality in Air-conditioning

Aerodynamics of an electric vehicle.

Air quality and its importance, the most common inherent impurities in air, indoor air quality investigation nad prediction in an automobile with case study.

Battery thermal management system, introduction to artificial neural networks, thermal optimization of PCM based pin fin heat sinks, .optimization of pin fin heat sink with ANN-GA approach, the use of nntool in MATLAB.

Day-1: Session-1 : Monday 24-06-2024, Dr.T.Srinivas, NIT, Jalandhar



Demonstration App Designer for Heat Transfer Laboratory

Dr B R Ambedkar National Institute of Technology Jalandhar, Punjab, India - 144008
 Heat Transfer Laboratory
 Developed by: Dr Tangellapalli Srinivas, Professor, Department of Mechanical Engineering, NIT Jalandhar, Punjab

Enter the experiment number: Press Evaluate button for the results

- Composite wall apparatus
- Lagged pipe
- Thermal conductivity of insulating power
- Thermal conductivity of metal rod
- Unsteady state heat transfer
- Heat transfer in pin fin
- Heat transfer in forced convection
- Heat transfer in natural convection
- Stefan Boltzman constant
- Emissivity measurement
- Heat transfer in drop and film wise condensation
- Critical heat flux
- Two phase heat transfer
- Concentric tube heat exchanger
- Heat pipe

Enter the bath temperature, °C:
 Enter the ambient temperature, °C:

Efficiency of fin=86.705024
 Natural Convection
 $dT, ^\circ C=106.000000$
 $T_{mf}, ^\circ C=73.000000$
 $V, m^3/s=0.003375$
 Area of duct, $m^2=0.015000$
 Velocity, $mps=0.224971$
 Velocity at $T_{mf}, mps=0.265645$
 Grashof number=12468.300431
 Nusselt number=4.704267
 heat transfer coefficient, $W/m K=11.538536$
 Fin perimeter, $m=0.037699$
 Fin parameter, $m=5.913143$
 Heat transfer, $W=4.720904$
 Efficiency of fin=89.412084

| Thermocouple distance, m | FC Temperature, °C | NC Temperature, °C |
|--------------------------|--------------------|--------------------|
| 0 | 95 | 95 |
| 0.023 | 89.166 | 95 |
| 0.046 | 84.93 | 95 |
| 0.069 | 82.192 | 95 |
| 0.092 | 80.884 | 95 |

Dr T Srinivas

Day-1: Session-2: Monday 24-06-2024, Dr.M.Subba Rao, Associate Professor, SR University, Warangal

SR UNIVERSITY

Emerging Trends and Innovations in Tribology

3rd National Level One Week Online Faculty Development Program On AI/ML Tools for Advanced Materials, Manufacturing and Thermal Systems (ATAMMTS-2024) (24th - 28th June 2024)

Organized by: Department of Mechanical Engineering
Lakireddy Bali Reddy College of Engineering

Presented by : Dr. M Subba Rao
 Assistant Professor and Associate Head
 Department of Mechanical Engineering
 SR University

24-06-2024 Page: 1/30

Dr. M. Subba Rao

4.1 Development of coating

Alloy Powder
 Oxygen
 Fuel Gas
 $NiCr$
 $70wt\%NiCr+30wt\%Al$
 $NiCrSiSiC$
 Flame Spray Process
 Partially Oxidized Powder
 Planetary ball milling
 Tungsten carbide balls
 Sieving
 Powder feeder
 Plasma Spray Process
 Power supply
 Inert Gas
 Substrate Coating

Dr. M. Subba Rao

4.2. Characterization

NiCrBSiFe

Oxide layer on the particle

NiCr

Oxide layer on the particle

Al

(b)

(c)

(e)

(f)

| | Adhesion strength | Micro hardness | Porosity | Density | Surface Roughness |
|-----------|-------------------|--------------------------|----------|-----------|-------------------|
| NiCrBSiFe | 12.92 MPa | 809±20 HV _{0.3} | <1.5% | 5.47 g/cc | 62.8 |
| NiCr | 10.88 MPa | 326±19 HV _{0.3} | <1.5% | 5.27 g/cc | 72.344 |
| NiCr+Al | 21.12 MPa | 310±12 HV _{0.3} | <1.5% | 3.83 g/cc | 86.006 |

Day-1: Session-3: Monday 24-06-2024, Dr.K.Venkat Rao, Vignan University, Guntur

Online modeling of weld bead geometry in metal arc based additive manufacturing using grey prediction model

Dr. K. Venkata Rao
 Professor
 Department of Mechanical Engineering
 VIGNAN'S UNIVERSITY

Objective of this study

- An actual and expected HNB in a multi pass weld bead in AM is shown in Fig. 2. It was observed that the HNB increased from starting position and the HNB gradually reduced at the end of the bead.
- In another study, Rao (2021) studied effect of torch angle on the HNB, DNB and width of weld bead and optimized the torch angle at 75° (Li et al., (2019) also suggested keeping
- Torch angle below 90° for better weld bead geometry (Rao, 2023)
- The current study aims to develop a GOM by predicting

Fig. 2 Actual and expected HNB in a multi pass weld bead in AM

Rao (2021) The use of teaching learning based optimization technique for optimizing weld bead geometry as well as power consumption in additive manufacturing. J. Clean Prod. 11 et al. (2019) Multiaxial stability of thin wall parts in robotic GMAW based additive manufacturing with various position depositors. Rob. Comp. Int. Manuf.

Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
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The 1-AGO sequences for the independent and dependent variables

$$T^{(1)} = (T^{(1)}(1), T^{(1)}(2), T^{(1)}(3), T^{(1)}(4), T^{(1)}(5), T^{(1)}(6), T^{(1)}(7))$$

$$= (5, 10, 15, 20, 25, 30, 35)$$

$$f^{(1)} = (f^{(1)}(1), f^{(1)}(2), f^{(1)}(3), f^{(1)}(4), f^{(1)}(5), f^{(1)}(6), f^{(1)}(7))$$

$$= (191.6, 366.9, 548.8, 736.3, 929.3, 1127.7, 1320.3)$$

$$\Delta f^{(1)} = (\Delta f^{(1)}(1), \Delta f^{(1)}(2), \Delta f^{(1)}(3), \Delta f^{(1)}(4), \Delta f^{(1)}(5), \Delta f^{(1)}(6), \Delta f^{(1)}(7))$$

$$= (0, 16.3, 22.9, 28.5, 34, 39.4, 45.2)$$

$$AF^{(1)} = (AF^{(1)}(1), AF^{(1)}(2), AF^{(1)}(3), AF^{(1)}(4), AF^{(1)}(5), AF^{(1)}(6), AF^{(1)}(7))$$

$$= (20.87 \times 10^{-3}, 41.01 \times 10^{-3}, 61.39 \times 10^{-3}, 82.01 \times 10^{-3}, 102.93 \times 10^{-3}, 124.02 \times 10^{-3}, 144.86 \times 10^{-3})$$

$$DWB^{(1)} = (DWB^{(1)}(1), DWB^{(1)}(2), DWB^{(1)}(3), DWB^{(1)}(4), DWB^{(1)}(5), DWB^{(1)}(6), DWB^{(1)}(7))$$

$$= (1.32, 2.33, 3.65, 5.15, 6.88, 8.84, 10.12)$$

$$HWB^{(1)} = (HWB^{(1)}(1), HWB^{(1)}(2), HWB^{(1)}(3), HWB^{(1)}(4), HWB^{(1)}(5), HWB^{(1)}(6), HWB^{(1)}(7))$$

$$= (2.70, 6.13, 9.18, 11.71, 14.43, 16.78, 19.8)$$

Day-2: Session-1: Tuesday 25-06-2024, Dr.T.Babu Rao, NIT Tadepalligudem, A.P

E-mail: thellababurao@nitandhra.ac.in Date: 25th June 2024

Sensor Technologies & DAQ for Real-time Monitoring of Wire-arc Additive Manufacturing Process


Dr. Theella Babu Rao, Asst. Professor
 Department of Mechanical Engineering
 National Institute of Technology Andhra Pradesh
 Old aerodrome, Near Kondruprolu, Tadepalligudem,
 West Godavari Dist., Andhra Pradesh, INDIA

Metal AM Technologies:


- Powder bed fusion (PBF) and Directed energy deposition (DED) are the most popular ones that use powder as feedstock material.
- PBF methods: Selective laser melting (SLM) and Selective laser sintering (SLS)
- An additional classification - metal AM processes:
 - **Direct-to-metal AM processes** - begin with a computer model and directly produce a net-shaped part.
 - **Indirect AM metal processes** - begin with a computer model, print an intermediate part, and then require additional intermediate processing steps such as casting, bulk sintering, or machining to attain a net-shaped part.
- PBF AM processes, and many DED processes, may be considered **direct-to-metal AM processes**.
- Binder jetting and ultrasonic additive manufacturing (UAM) are considered **indirect metal AM processes**.
- While nearly all applications of AM fabricated metal parts require some degree of post-processing, heat treatment, finishing, etc.

AI/ML Tools for Advanced materials manufacturing and Thermal systems

Metal AM: Wire-feed Technologies



- GTAW**
 - Non-consumable electrode
 - Typical deposition rate: 1-2kg/hr
 - Highly potential in large-scale part production due to its high energy efficiency, and high deposition rate.
- GMAW**
 - Consumable electrode
 - Typical deposition rate: 3-4kg/hr
 - Poor arc stability
 - CMT: Low heat input with zero spatter
- PAW**
 - Non-consumable electrode
 - Typical deposition rate: 2-4kg/hr
 - Separate wire feed process
- WLAM**
 - A laser system,
 - An automated wire-fed supply unit,
 - A robot, and various accessory devices



Dr. Thella Babu Rao, Assistant Professor, NIT Andhra Pradesh

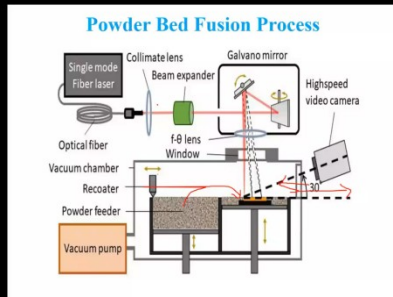
Day-2: Session-2, 25-06-2024, Dr.A.Manmadha Chary, ICAFI University, Hyderabad

One week online Faculty Development Programme
on
AI/ML Tools for Advanced Materials, Manufacturing and Thermal Systems(ATAMMTS-2024)

Thermo-mechanical Analysis of Powder Bed Fusion (PBF) Additive Manufacturing (AM) process

Dr. A. Manmadha Chary
Associate Professor,
Department of Mechanical Engineering,
Icfaitech - Institute of Computational Technology,
IFHE University, Hyderabad, Telangana, India.

Powder Bed Fusion Process

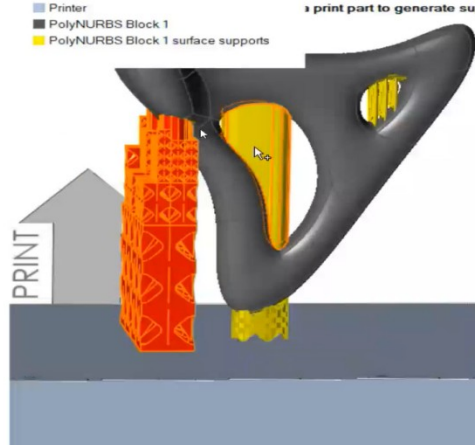


print part to generate supports.

Printer

PolyNURBS Block 1

PolyNURBS Block 1 surface supports



Generate

Support Type

Pattern

Distance to contour: 0.2 mm

Pattern angle: 0 deg

Cells

Min cell size: 2 mm

Max subdivision levels: 2

Min n° of smallest cells: 3

Tip

Tip intrusion: 1 mm

Tip height: 1.5 mm

Dr. A. Manmadha Chary

Application of ultrasonic vibrations in FSWP

Dr. L.S. Raju, Prof.
 Dept. of Mech. Engg.
 E-mail: rajudme@nitttrbpl.ac.in

Surface morphology of Grooved FSPed zones

Figure: Surface morphology at different parameter conditions for Groove FSP method:

| | | |
|---|--|--|
| a) 900 TRS, 40 TS, 2 V% b) 900 TRS, 50 TS, 4 V% c) 900 TRS, 60 TS, 6 V% | d) 1100 TRS, 40 TS, 4 V% e) 1100 TRS, 50 TS, 6 V% f) 1100 TRS, 60 TS, 2 V% | g) 1400 TRS, 40 TS, 6 V% h) 1400 TRS, 50 TS, 2 V% i) 1400 TRS, 60 TS, 4 V% |
|---|--|--|

All Surface composites are radio graphically tested and found defect free

TEM Analysis

Figure: TEM analysis of
 a) Grooved FSP sample b) Blind holed FSP sample
 c) Grooved UAFSP sample d) Blind holed UAFSP sample at optimum condition

- TEM micrograph of the UAFSPed grooved and blind holed Nano composites shows relatively uniform dispersion of reinforcing particles within and at the grain boundaries.
- In Grooved FSP mixed (fine and coarse), the grain size is reduced from 89.35 nm to 29.4 nm
- Where in blind-holed UAFSP, the fine grain size is further reduced upto 15.3 nm
- It has been proposed that grain growth is restrained by the reinforcements, due to their pinning effect resulting in grain refinement and finer grain size

Machine Learning for Material Science

Dr. Srinivasu Gangi Setti
 Assistant Professor
 Mechanical Engineering
 National Institute of Technology Raipur
 D. Raipur - 492010

Machine Learning Methods

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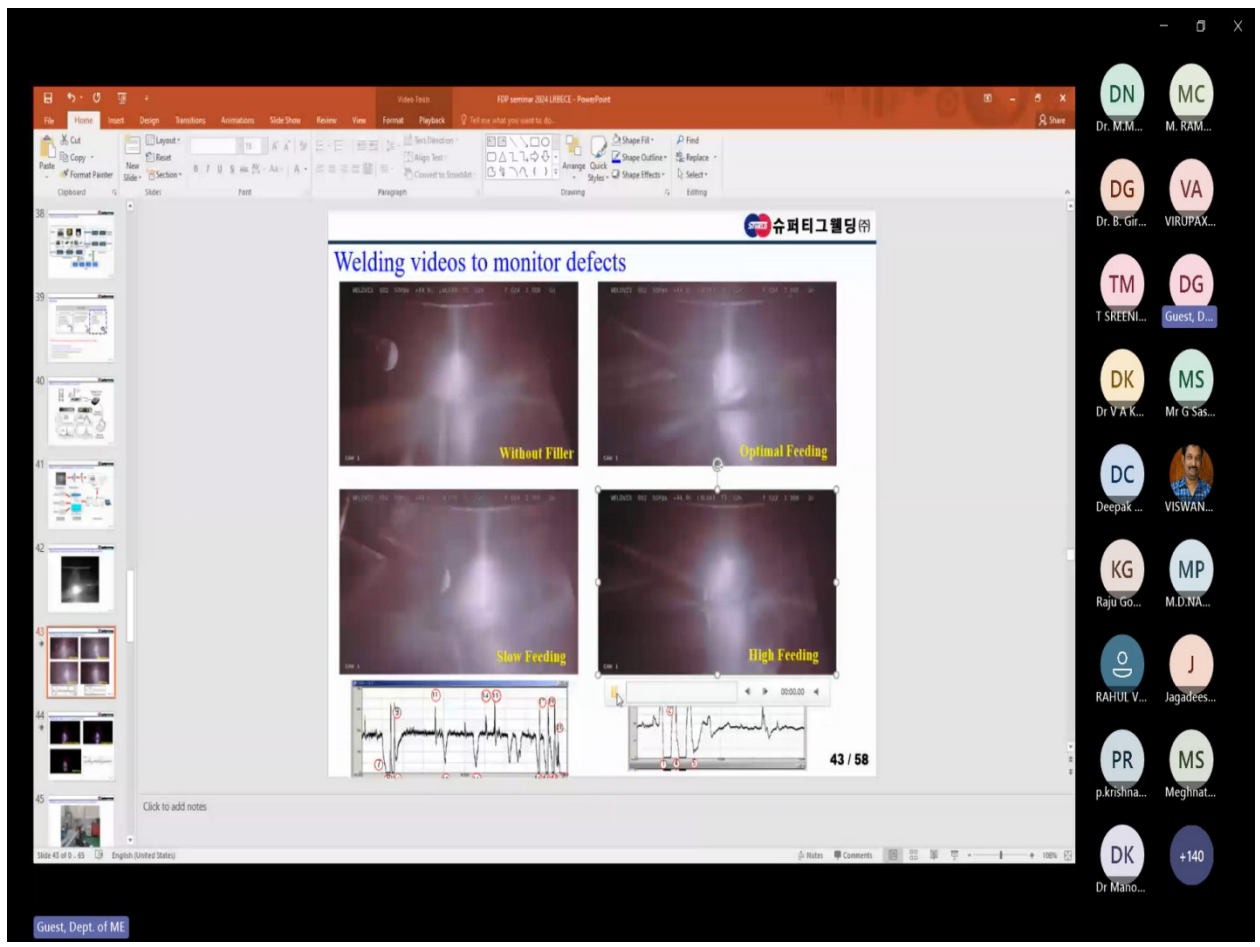
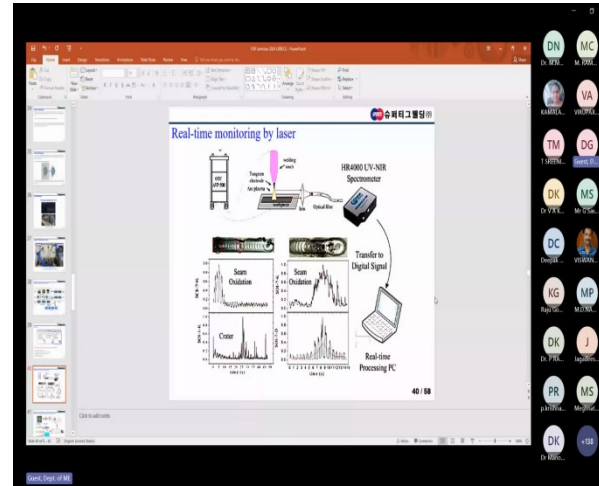
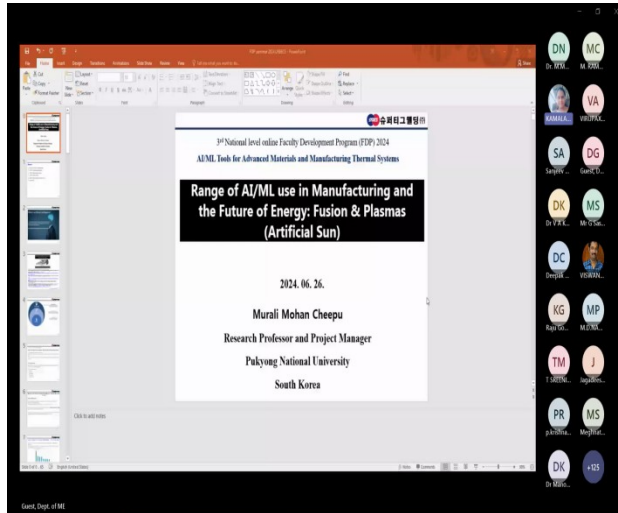
    graph TD
      ML[Machine Learning] --> S[Supervised]
      ML --> U[Unsupervised]
      ML --> RL[Reinforcement Learning]
      S --> R[Regression]
      S --> C[Classification]
      S --> Cl[Clustering]
      R --> R1["(i) Linear,  
(ii) Polynomial,  
(iii) Support vector,  
(iv) Random forest,  
(v) Neural network,  
(vi) Gaussian process"]
      C --> C1["(i) Logistic  
(ii) Support vector,  
(iii) Neural network"]
      Cl --> Cl1["(i) K-means,  
(ii) F-SNE,  
(iii) DBSCAN,  
(iv) K-NN"]
      RL --> RL1["(i) Markov decision processes  
(ii) Value prediction problems  
(iii) Control"]
    
```

Fig. 2 - The machine learning paradigm includes supervised, unsupervised, and reinforcement learning algorithms

ML Application in Material Science

| Applications | Machine Learning Algorithms |
|---|--|
| Crack detection, dislocation classification | Artificial neural networks, Gaussian naive Bayes classifier |
| Gas adsorption prediction in metal-organic frameworks | Support vector regression, random forest, ridge linear regression |
| Characterization of crystal/ atomic structure | Principal component analysis, linear regression, wavelet transforms, artificial neural networks, convolutional neural network, Bayesian inference, Gaussian mixture model clustering, random forest, Huber regression, artificial neural network, SVMs, relevance vector machines, XGBoost |
| Development of new materials | Data mining, artificial neural networks, sketch-map, support vector regression, random forest regression, least absolute shrinkage and selection operator (LASSO) regression |
| Mapping between crystal/atomic structure and properties | Kernel ridge regression algorithm, Gaussian process regression technique, Chi-square test, information gain, F-score, support vector machines (SVMs), decision tree, artificial neural networks, random forest, linear leastsquare, k-nearest neighbors, symbolic regression |

Day-3: Session-2, Wednesday 26-06-2024 Dr.Ch.Murali Mohan, Pukyong University,
Busan, South Korea



Day-4: Session-1, Thursday 27-06-2024 Dr.Priyaranjan Sharma, KLEF University

Role of AI and ML in WEDM Process

| Role | AI | ML |
|-------------------------------|--|---|
| Energy Efficiency | Optimizes energy consumption, reducing costs. | Enhances energy efficiency by optimizing process parameters. |
| Cost Reduction | Lowers operational costs through efficiency and waste reduction. | Reduces costs by improving process efficiency and minimizing waste. |
| Enhanced Precision | Achieves higher precision by fine-tuning parameters. | Improves accuracy by learning from past data. |
| Customizable Workflows | Enables workflows tailored to specific project requirements. | Tailors machining strategies based on specific material and design needs. |

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Day-4: Session-2, Thursday 27-06-2024 Dr.Rajesh Baby, SJCTET, Palai, Kerala

Multilayer feed forward network

The diagram illustrates a neural network with three layers: an input layer with neurons x_1, x_2, \dots, x_ℓ ; a hidden layer with neurons y_1, \dots, y_m ; and an output layer with neurons z_1, z_2, \dots, z_n . Weights v_{ij} connect the input layer to the hidden layer, and weights w_{jk} connect the hidden layer to the output layer.

Dr. Rajesh Baby (Guest)

Day-4: Session-3, Thursday 27-06-2024 Dr.Chandan Kumar, SRM University

Meeting: 09:30 91 attendees
 Notifications (1)
 SRM UNIVERSITY
 Dr. Chandan K (Unverified)

Participants: GM, DK, DK, SV
Principle of Laser Generation
 Light amplification by Stimulated Emission of Radiation
 Step 1: Pump energy, Excited state, Laser photon, Ground state
 Step 2: Pump energy, Excited state, Two laser photons, Ground state
 Step 3: Resonator

Beam power of 800 W

Temperature profile around the laser heat source increases rapidly from ambient temperature of 27°C to peak temperature of around 3550°C for the time interval of 0 to 1 s.

The rise of peak temperature continuously increases during the time interval of 1 to 7.5 s. At this time the peak temperature reaches up to 467°C . The time interval between 0 to 1 s is called as initial transient stage.

At the end of 7.5 s, the peak temperature is observed as approximately 467°C .

Fig. Temperature distribution at different time (a) 1 s, (b) 2.5 s, (c) 3.5 s and (d) 7.5 s at 400 mm/min welding speed

Day-4: Session-4, Thursday 27-06-2024 Dr.P.Karthik, Research Engineer, Florida Solar Energy Center, Florida Central University, Florida, USA

Basics of Data Mining - Machine Learning - With Building Energy Systems as Examples

Karthik Panchabikesan, Ph.D.,
 Research Engineer, Buildings Research Division,
 Florida Solar Energy Center (FSEC),
 University of Central Florida, UCF, Florida, USA

June 27, 2024

Data mining - Knowledge Discovery in Databases

The diagram illustrates the KDD process: Data is selected and preprocessed into Target Data. This data is then transformed into Transformed Data, which is used for Data Mining to identify Patterns. Finally, these patterns are interpreted and evaluated to gain Knowledge.

http://www2.cs.uoregina.ca/~dhd/cs831/notes/kdd/1_kdd.html

Investigating thermostat setpoint preferences across Canada

Statistical analysis
 → Variation in average heating and cooling setpoint temperature and average outdoor temperature across provinces with respect to HVAC schedule options.

Random forest models
 → Ranking the importance of the attributes influencing heating and cooling setpoint temperatures using Random Forest Models

Attributes importance - HSPT
 Attributes importance - CSPT

University of Central Florida

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Day-4: Session-5, Thursday 27-06-2024 Dr.D.Chakradhar, IIT, Palakkad

ARTIFICIAL INTELLIGENCE IN MANUFACTURING

Dr. D. CHAKRADHAR
 Associate Professor
 Dept. of Mechanical Engineering
 IIT PALAKKAD

Nurturing minds for a better world


Artificial
 Not natural

Intelligence
 Ability to understand, think and learn

APPLICATION OF FUZZY LOGIC IN WIRE EDM PROCESS

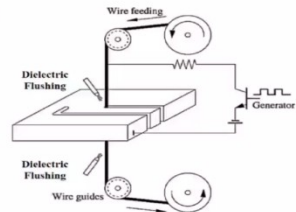
Objective:
 To predict the responses of wire EDM process using fuzzy logic

a)



(a) Wire-EDM equipment

b)



(b) Schematic of machining
(Bisaria and Shandilya, 2015)

Guest, Dept. of ME

VISWAN... Vishnu s...

ST Dr. Vine... VV Vetrivel...


RH Raghava... AP Anil Kar...

MC M. KAR... DG Dr. B. Gir...

M Mr. CH... VG VIJAYKA...

DS +86 Dr C Sub...

Day-5: Session-1, Friday 28-06-2024 Dr.P.Praveen Kumar, Karunya University

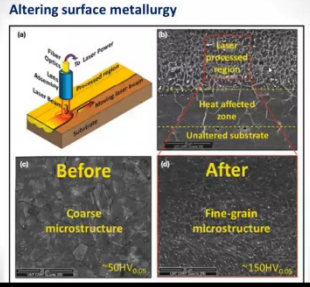


Karunya INSTITUTE OF TECHNOLOGY AND SCIENCES
(Declared as Deemed to be University under Sec 3 of the UGC Act, 1956)
 MAAC, UGC & AICTE Approved
 NAAC A++ Accredited

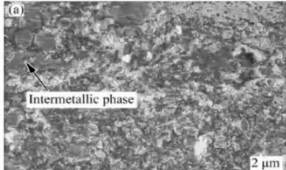
Surface Development of Aluminium Alloys and Composites by Advanced Surface Modification Technologies

Dr. Praveen Kumar Bannaravuri
 Assistant Professor,
 Division of Mechanical Engineering,
 Karunya Institute of Technology and Sciences,
 Coimbatore-641114

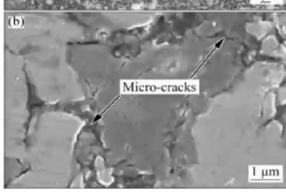
Altering surface metallurgy



(bottom) and untreated zone (top) of matrix alloy

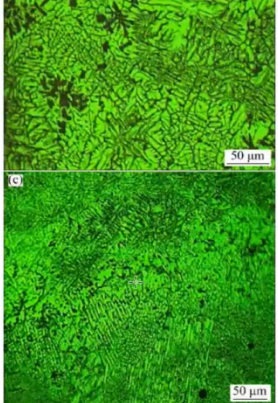


(a) Intermetallic phase
2 μm



(b) Micro-cracks
1 μm

Fig. 7 SEM images of LSM-treated Al-4.5Cu alloy at LSE of 45 J/mm²: (a) Intermetallic phase; (b) Micro-cracks



(c) Fine grain microstructure
50 μm

Fig. 8 Microstructures of LSM-treated Al-4.5Cu/10SiC/2MoS₂ composite at various LSEs: (a) 32 J/mm²; (b) 38 J/mm²; (c) 45 J/mm²

Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
 Department_Report of Online FDP organized from 24-06-2024 to 28-06-2024

Day-5: Session-2, Friday 28-06-2024 Dr.P.Thirumal, GEC, Bargur

Indoor Air Quality Investigation and Predictions in Automobile - Case Study
 26 JUNE 2024
 Dr.P.Thirumal,
 Professor and Head,
 Department of Mechanical Engineering,
 Government Engineering College,
 Bargur (TN)

Experiment output converted into Fuzzy rule

| Rule Number | Human Load | Fresh Air Supply | Air Velocity | Carbon Dioxide Level | Temperature | Relative Humidity |
|-------------|------------|------------------|--------------|----------------------|-------------|-------------------|
| 1 | Very Low | Very Low | Very Low | Very Low | Medium | Very Low |
| 2 | Very Low | Very Low | Low | Very Low | Medium | Very Low |
| 3 | Very Low | Very Low | Medium | Very Low | Low | Low |
| 4 | Very Low | Very Low | High | Very Low | Very Low | Low |
| 5 | Very Low | Low | Very Low | Very Low | High | Very Low |
| 6 | Very Low | Low | Low | Very Low | Medium | Low |
| 7 | Very Low | Low | Medium | Very Low | Low | Medium |
| 8 | Very Low | Low | High | Very Low | Low | Medium |
| 9 | Very Low | Medium | Very Low | Very Low | High | Very Low |
| 10 | Very Low | Medium | Low | Very Low | High | Low |
| 11 | Very Low | Medium | Medium | Very Low | Medium | Low |
| 12 | Very Low | Medium | High | Very Low | Low | Medium |
| 13 | Very Low | High | Very Low | Very Low | Very High | Low |
| 14 | Very Low | High | Low | Very Low | High | Low |
| 15 | Very Low | High | Medium | Very Low | High | Medium |
| 16 | Very Low | High | High | Very Low | Medium | Medium |
| 17 | Low | Very Low | Very Low | Very Low | High | Low |
| 18 | Low | Very Low | Low | Very Low | Medium | Low |
| 19 | Low | Very Low | Medium | Very Low | Low | Low |
| 20 | Low | Very Low | High | Very Low | Low | Medium |

Fuzzy Rule Viewer

Human Load = 2 Fresh Air Supply = 100% Air Velocity = 4 m/s Carbon dioxide level = 628 ppm Temperature = 22 °C Relative Humidity = 54%

Input: [2 100 4] Plot Points: 101 Move: Left, Right, Down, up 74

Day-5: Session-3, Friday 28-06-2024 Dr.M.Krishna Kishore, SVNIT, Surat

3rd NATIONAL LEVEL ONE WEEK ONLINE FACULTY DEVELOPMENT PROGRAM
 On
 AI/ML Tools for Advanced Materials, Manufacturing and Thermal Systems (ATAMMTS-2024)
 (24th - 28th June 2024)

Aerodynamics of an Electric Vehicle

Dr. Krishna Kishore Mugada,
 Assistant Professor
 Department of Mechanical Engineering

Sardar Vallabhbhai National Institute of Technology, Surat,
 Gujarat, India-395007.
 Email: kkm@med.svnit.ac.in; Phone: +91 9505674467 / +91-7569617706.

Effects of Vibration on a Battery Pack

- Welding failures**
 -Spot weld failure between cell tabs and busbars.
 -Loose busbar contact yields to high contact resistance and high busbar temperature.
- Fasteners loosen up**
 -Busbar bolts, BMS bolts or casing bolts may loose.
- Component level failure due to resonance**
 -Components fail when excitation frequency becomes same as their natural frequency.
- Electronic components failure**
 -Small components including ICs and MOSFETs may break contact.
- Cracks propagation on plastic components**
 -Outer plastic casing.
- Battery capacity may reduce**
 -Due to weld failures in cell terminals.

Function of a BMS

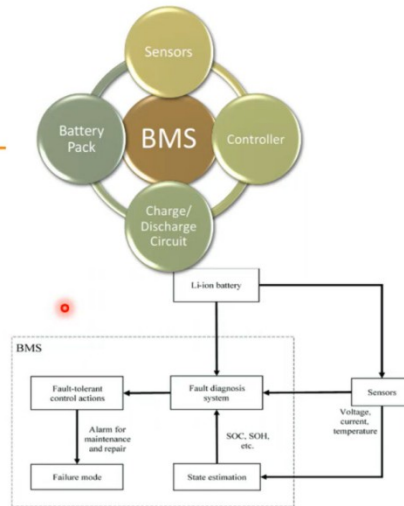
1. Cell monitoring

2. Measurement of

- Voltages
- Current
- Temperatures (Cell and Ambient)
- Pressure (Cell and Ambient)

3. Safety

- Over Charge
- Over discharge
- Short circuit
- Temperature
- Polarity



Source: A Review of Lithium-Ion Battery Fault Diagnostic Algorithms: Current Progress and Future Challenges

Dr. Krishna Kishore

CP
CHANDR...

MR
M. Venk...

MR
Mr. Chev...

NR
Dr. Vini...

ST
Dr. Vini...

DG
Dr. B. Gir...

SD
Sunil Ku...

D
Dr. Muth...

TS
T. SOMA...

MF
Michael ...

S
S. Madha...

MV
Manjuna...

RR
R. VISTIN...

VM
Vijay Mi...

DK
Dr. Krish...

+157



DEPARTMENT OF MECHANICAL ENGINEERING

One Week online Faculty Development Programme on

“AI/ML Tools for Advanced Materials Manufacturing and Thermal Systems” ATAMMTS-2024

24th June 2024 - 28th June 2024 ; Timings 9.30AM to 12.30AM.

Program Objective: To impart the knowledge of advancements and current research in the area of AI/ML tools applied for advanced materials, manufacturing and thermal system technologies happening around the globe.

Program Outcomes: The participants were able to

1. Understand the importance of developing the AI/ML tools for advanced materials, manufacturing and thermal systems to address the current issues in the above domains.
2. Comprehend the necessity of learning ANN, MATLAB, FUZZY tools for optimizing the performance of systems
3. Recognize the significance of modelling, simulation, analysis and optimization of manufacturing and thermal systems for solving complex engineering problems
4. Know the importance of developing the Data science tools for optimizing the energy for green energy systems and net zero energy buildings
5. Apply the ANN and genetic algorithms for optimization of thermal energy storage systems
6. Describe AI/ML tools basics applicable for manufacturing, thermal equipment performance enhancement

COORDINATORS

1. Dr. Ch. S. S. Babu
Assoc. Professor

2. Dr. K. Murahari
Assoc. Professor

3. Dr. P. Vijay Kumar
Professor

CONVENER

Dr. M. B. S. S. Reddy
Professor and Head

Lakireddy Bali Reddy College of Engineering - Mechanical Engineering Department Report of Online FDP organized from 24-06-2024 to 28-06-2024

Resource Persons

Dr.P.Karthik, Research Engineer, FSCE, USA
Dr. Ch.Murali Mohan, Buasn South Korea
Dr.D.Chakradhar, IIT, Palakkad
Dr.T.Srinivas, NIT, Jalandhar
Dr.L.Suvarna Raju, NITTTR, Bhopal
Dr.M.Krishna Kishore, NIT Surat
Dr.G.Srinivasu, NIT Raipur
Dr.T.Babu Rao, NIT Tadepalligudem
Dr.P.Thirumal GEC, Bargiur
Dr.Rajesh Baby, SJCE, Palai, Kerala
Dr.K.Venkat Rao, Vignan Guntur
Dr.A.Manmadha chary, ICFAI, Hyderabad
Dr.P.Praveen, Karunya University
Dr.Chandan Kumar, SRM University
Dr.M.Subba Rao, SR University
Dr.Priyaranjan Sharma, KLEF

Registration Fee: No Registration Fee.

Target Audience:

Faculty and research scholars from the state, spread across India and Abroad

Important Date:

Last Date for Registration: 21/06/2024

Registration Link:

Fill the Registration form with the following link:
<https://forms.gle/vKBY3NYsJNFQK8z86> Join the
WhatsApp group to get the updates:
<https://chat.whatsapp.com/HyRLHA3tYXl7teh9vriMwC>
Online FDP will be organized in
Microsoft Teams Platform

Certificate Criteria:

- All eligible candidates who meet the criteria will get e-certificates.
- Attendance is mandatory.

For more details contact:

Dr.P.Vijaya Kumar: +91-9490017851
Dr. K. M u r a h a r i : +91-8074139826
Dr.Ch.S.S.Babu +91 9000350390

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Dr.Ch.S.S.Babu, Assoc.Professor

Co-ordinators

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Mr.V.Sankara Rao, Sr.Assistant Professor

Advisory committee

Dr.P.V.Chandrasekhara.Rao, CoE
Dr.P.Ravindra Kumar, Professor
Dr.K.Dilip Kumar, Professor

Organizing committee

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Mr.J.Subba Reddy, Associate Professor
Dr.B.Sudheer Kumar, Sr.Assistant Professor
Mr.S.Rami Reddy, Sr.Assistant Professor
Mr.S.Srinivasa Reddy, Sr.Assistant Professor
Dr.A.Nageswara Rao, Sr.Assistant Professor
Mr. K.L.Prasad, Assistant Professor
Mrs.B.Kamala Priya, Assistant Professor

ONE WEEK ONLINE

FACULTY DEVELOPMENT PROGRAM

On

AI/ML Tools for Advanced Materials,
Manufacturing and Thermal Systems

(ATAMMTS-2024)

(24th - 28th June 2024)



Organized by
Department of
Mechanical Engineering
(Accredited by NBA under Tier - I)

LAKIREDDY BALI REDDY COLLEGE OF
ENGINEERING

(Autonomous)



Accredited by NAAC & NBA (CSE, IT, ECE, EEE, MECH)
ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi and Affiliated to JNTUK,
Kakinada
L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-
521 230

AI/ML Tools for Advanced materials manufacturing and Thermal systems

Lakireddy Bali Reddy College of Engineering - Mechanical Engineering

Department Report of Online FDP organized from 24-06-2024 to 28-06-2024

About the Institute:

LBRCE was founded through Lakireddy Bali Reddy charitable trust in 1998 which stands for quality technical education that is exemplified by the continuous strides taken towards excellence in the last two decades. LBRCE started with an intake of 180 and has reached the current intake of 1164. UGC has accorded Autonomous Status in the year 2010, subsequently renewed in 2016, valid up to 2022. LBRCE has been accredited by NAAC with Grade 'A' and NBA (ECE, IT, CSE, EEE & MECH) under Tier-I. The College has also been awarded 2(A) and 12(B) status, apart from the recognition as a 'College with Potential for Excellence (CPE)' status from the UGC. Our institute has pride to have large pool of well-qualified and experienced faculty.

About the Department:

The Department of Mechanical Engineering was started in the year 1998. It has well qualified faculty and well-equipped laboratories.

The Department is accredited by NBA under Tier-I. About 25% of faculty members having doctoral degree. JNTUK Kakinada has accorded Research Centre to the Department and several research scholars are pursuing their Ph.D. The Department received sponsored research projects worth Rs.1.5 Crore from various GOI funding agencies.

About the FDP:

The one-week online FDP is aimed at enriching the knowledge and research capabilities of faculty and research scholars of academia and R&D centers working in the applications of AI/ML tools in the domains of Advanced materials, Manufacturing, Thermal systems. This FDP also covers simulation, modeling, and optimization techniques using Ansys, Matlab, Neural Networks, Taguchi, RSM tools.

This program is useful for participants who are doing research work in the performance enhancement and optimization of thermal and renewable energy systems area.

Eminent professors from India and Abroad are drawn from the highly reputed institutes (IIT, NIT, R&D centers) have been invited for FDP.

Objectives of the FDP:

- To know the latest developments in the domains of Advanced materials, Manufacturing and Thermal systems.
- To get exposed to the latest simulation, modeling and optimization techniques.
- To get acquainted with the advancements and application of AI/ML tools in the domains of Advanced materials, Manufacturing and Thermal systems.

Topics to be covered:

- Data Mining tool for thermal system energy optimization
- Neural Networks for optimization of indoor air quality improvement
- Application of Artificial Neural Networks in thermal engineering
- App. Designer tool for modeling and simulation of thermal systems

Learning Outcomes:

- Acquire the latest technological changes happening in the areas of Advanced materials, Manufacturing and Thermal systems with AI/ML tools
- Optimize the performance parameters of different machines and systems with latest tools
- To improvise and predict the solutions for problems in the emerging fields of Electric vehicles, Hydrogen energy, Additive manufacturing using AI/ML/ANN and other tools.



LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
 (AUTONOMOUS)



Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME) under Tier - I

Approved by AICTE and Permanently Affiliated to JNTUK, Kakinada

DEPARTMENT OF MECHANICAL ENGINEERING

**One week online Faculty Development Programme on
 AI/ML Tools for Advanced Materias, Manufacturing and Thermal
 Systems(ATAMMTS-2024)**

24th – 28th June 2024

Programme Schedule

| S.No | Day | Date & Time | Resource Person | Topic to be delivered |
|--|---------|---------------------------------|---|--|
| DAY-1 (Inauguration @9.15AM on Monday 24-06-2024) | | | | |
| 1 | MONDAY | 24-06-2024 9.30AM - 10.30AM | Dr. T.Srinivas, NIT, Jalandhar. | App Designer for modeling and Simulation of Thermal Systems |
| 2 | MONDAY | 24-06-2024 10.30AM - 11.30AM | Dr.K.Venkat Rao Vignan University Vadlamudi, Guntur | Online modeling and monitoring of wall geometry in metal based additive manufacturing |
| 3 | MONDAY | 24-06-2024 11.30AM - 12.30PM | Dr. M.Subbarao S.R University Warangal | Emerging Trends and Innovations in Tribology |
| DAY-2 | | | | |
| 4 | TUESDAY | 25-06-2024 9.30AM - 10.30AM | Dr. Thella Babu Rao, NIT, A.P | Sensor technologies and DAQ for real-time monitoring of metal additive manufacturing process |
| 5 | TUESDAY | 25-06-2024 10.30AM - 11.30AM | Dr. A.Manmadha Chary ICFAI, Hyderabad | Thermal Analysis of Powder Bed Fusion (PBF) Additive Manufacturing (AM) process |
| 6 | TUESDAY | 25-06-2024 | Dr. Lam Suvarna Raju NITTTR, Bhopal | Application of ultrasonic vibrations in |


**Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
Department Report of Online FDP organized from 24-06-2024 to 28-06-2024**

| | | | | |
|--------------|---------------|--|---|--|
| | | 11.30AM - 12.30PM | | FSW/P |
| DAY-3 | | | | |
| 7 | WEDNESD AY | 26-06-2024 9.30AM - 10.30AM | Dr.G.Srinivasu NIT Raipur | Macine Learning in Material Science |
| 8 | WEDNESD AY | 26-06-2024 10.30AM - 11.30AM | Dr. Chandan Kumar SRM University, A.P | Advanced Laser machining |
| 9 | WEDNESD AY | 26-06-2024 3PM - 4.30PM | Dr.P.Karthik Research Engineer, Buildings Research Florida Solar Energy Center, Florida, USA | Basics of Datamining - Machine Learning with building energy sytems as example |
| DAY-4 | | | | |
| 10 | THURSDA Y | 27-06-2024 9.30AM - 10.30AM | Dr. Priyaranjan Sharma, KLEF, Vaddeswaram | Advanced machining process Wire EDM(Principle, Advantages&Applicatio ns, Future challenges and role of AI/ML) |
| 11 | THURSDA Y | 27-06-2024 10.30AM - 11.30AM | Dr.Rajesh Baby, Dean-Research, St.Joseph's College of Engineering and Technology, Palai, Kerala | Thermal system optimization using artificial neural network – Genetic algorithm(ANN- GA)approach |
| 12 | THURSDA Y | 27-06-2024 2PM - 3.30PM | Dr.Murali Mihan Cheepu, Buasn, South Korea | Range of AI/ML use in manufacturing and the future of energy fusion&plasma(Artificia l Sun) |
| DAY-5 | | | | |
| 13 | FRIDAY | 28-06-2024 9.30AM - 10.30AM | Dr. P.Praveen Kumar Karunya University Chennai | Surface development of Aluminium alloys and composites by advanced surface modification technologies |
| 14 | FRIDAY | 28-06-2024 10.30AM - 11.30AM | Dr.P.Thirumal, Government Engineering College, Bargur | Indoor air quality investigation and prediction in an |



AI/ML Tools for Advanced materials manufacturing and Thermal systems

**Lakireddy Bali Reddy College of Engineering - Mechanical Engineering
Department Report of Online FDP organized from 24-06-2024 to 28-06-2024**

| | | | | |
|---|--------|--|----------------------------------|---|
| | | | | automobile - case study |
| 15 | FRIDAY | 28-06-2024 11.30AM - 12.30PM | Dr.D.Chakradhar, IIT Palakkad | Artificial Intelligence in manufacturing |
| Valedictory starts from 12.30PM onwards with feedback from participants | | | | |




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DEPARTMENT OF MECHANICAL ENGINEERING

**FEEDBACK ANALYSIS OF ONE WEEK ONLINE FDP ON
"AI/ML TOOLS FOR ADVANCED MATERIALS, MANUFACTURING AND THERMAL SYSTEMS"**

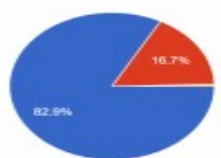
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| Aspect | Excellent | Very Good | Good | Satisfactory |
|--|-----------|-----------|------|--------------|
| DELIVERY CONTENT OF THE SPEAKER | 300 | 100 | 20 | 10 |
| TEACHING SKILLS OF THE SPEAKER | 300 | 100 | 20 | 10 |
| CLARIFICATION OF DOUBTS BY THE SPEAKER | 300 | 100 | 20 | 10 |

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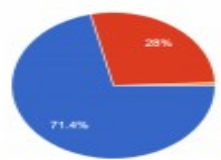
461 responses



| Category | Percentage |
|-------------------|------------|
| VERY MUCH USEFUL | 92.9% |
| MODERATELY USEFUL | 16.7% |
| NOT USEFUL | 0.4% |

LEVEL OF SATISFACTION OF THE LECTURE(S) [Copy](#)

461 responses



| Category | Percentage |
|---------------------|------------|
| VERY MUCH SATISFIED | 71.4% |
| SATISFIED | 29% |
| SOMEWHAT SATISFIED | 0% |
| NOT SATISFIED | 0% |

Handwritten Signature
HOD