

INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI भारतीय प्रौद्योगिकी संस्थान तिरुपति

Department of Mechanical Engineering

About the Department



The Department of Mechanical Engineering at IIT Tirupati was established in Jul 2015. At present, the department comprises thirteen full-time faculty members, and twelve staff members.

The department houses well equipped laboratories, which are used for both instruction and research. Our major thrust areas in research include Advanced Manufacturing, Advanced Materials. Renewable Energy, Theoretical and applied mechanics, and Precision Agriculture and Food Processing.

- Faculty strength: 13
- Research scholars: 38



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Dr. Madan Mohan

Research Activities in Advanced Manufacturing



Advanced Welding Research Activities

Tandem Submerged Arc Welding Dissimilar metal joining of Aluminum Narrow gap joining using Tandem to Steel using Hot wire GTAW process Gas Metal Arc Welding process LINC **Friction Stir** 21.35 1.38 (a) Welding of SMA 8.98 5 mm Prediction of CFD modeling Numerical modeling of dimensions and of Tandem welding processes temperature SAW process distribution End user: Automobile Industries End user: Marine Industry

Project funded by: DRDO



End user: Heavy Fabrication Industries Project funded by: NRB End user: Automobile Industries Project funded by: SERB

Additive Manufacturing Research Activities

Wire Arc Additive Manufacturing (WAAM)



End user: Aerospace Industry Project funded by: IIT Tirupati







Pelton wheel bucket

Numerical modeling of WAAM processes (wall over a base plate)





N95 mask prototype

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) Power Bed Fusion (PBF)

 Research is focus on the Selective laser melting of medical implants and aerospace components

Numerical modeling of PBF (cuboid over a base plate)



End user: Aerospace and medical Industries Project funded by: In review

End user: Prototyping medical Industries Project funded by: SERB Project funded by INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI

Micro-Nano-Bio-Machining Research Activities





Advanced Casting Research Activities

Foundry 4.0

- Stir Casting
- Squeeze Casting
- Pressure Infiltration
- Vacuum Casting
- Vacuum Arc Melting
- Induction Melting
- Simulation



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Advanced Metrology Research Activities

- 1. Development of accurate algorithms for *Form errors' evaluation* such as Straightness, Flatness, Circularity, Cylindricity etc.
- 2. Algorithms can be deployed in CMMs and Form testers
- 3. Availability of major Metrology equipment like
 - a) CMM
 - b) Autocollimator
 - c) 3D scanner
 - d) Form tester
 - e) Contour and roughness testers







Autocollimator

Form tester





Roughness & Contour tester





Research Activities in Fluid & Thermal Sciences





Hydrogen and Energy Storage Research Activities

Studying effect of impurities, cycling studies on hydrogen storage characteristics of metal hydrides



Reversible Alkali Metal Based Hydrides for High Temperature Thermal Energy Storage



Project Funded by: MHRD Collaborating Institutes: IITB, IITG, IITRPR

Project Funded by : DST Collaborating Institutes: IITB, IITG, IITI



Hydrogen and Energy Storage Research Activities

Development of High-Pressure Thermal Hydrogen Compressor



Synthesis and Characterization of Thermochemical Materials for Solar Thermal Energy Storage



Project Funded by : DST Collaborating Institutes: IITB, IITG, IITK, NITRKL

Project Funded by : SERB Collaborating Institutes: MGRCE, Vizianagaram



Sprays and Combustion Research Activities

Micro explosion in fuels



Micro explosion in fuel drops



End user: Automobile Industry Project funded by: IIT Tirupati



High Viscosity liquid Atomization



Atomization of Viscous liquids



CO₂ Capture from flue gas



Spray characterisation setup

End user: Food Processing Project funded by: SERB End user: Power Industry Project funded by: DST



Fluid Energy & Renewable Technology

- Indigenous design and development of a first of its kind six-component, scalable balance for dynamic measurements of force and moment vectors (IIT Tirupati funded)
- Design and development of a fully autonomous, scalable, fixed-wing drone based system, with longest endurance in its class in India, that can characterize flow behind a wind turbine. (SERB funded)
- Design and development of India's lowest turbulence, open- and closed-circuit, scalable wind tunnel test facility. (IIT Tirupati funded)







Fluid Mechanics & Modelling Research Activities

Modeling interfacial wave dissipation



of fluid flow	
$\frac{\partial u_i}{\partial t} = -\frac{1}{\rho_i} \left(\frac{\partial p_i}{\partial x} \right) + \nu_i \left[\frac{\partial^2 u_i}{\partial x^2} + \frac{\partial^2 u_i}{\partial z^2} \right]$], $\frac{\partial u_i}{\partial u_i} + \frac{\partial w_i}{\partial u_i} = 0$
$\frac{\partial w_i}{\partial t} = -\frac{1}{\rho_i} \left(\frac{\partial p_i}{\partial z} \right) + \nu_i \left[\frac{\partial^2 w_i}{\partial x^2} + \frac{\partial^2 w_i}{\partial z^2} \right]$	$\begin{bmatrix} -\partial x & -\partial z \end{bmatrix},$
$\boxed{\frac{\partial \eta}{\partial t} = w_i, \qquad \qquad w_1 = w_2,}$	$u_1 = u_2,$
$\rho_1 v_1 \left[\frac{\partial u_1}{\partial z} + \frac{\partial w_1}{\partial x} \right] - \rho_2 v_2 \left[\frac{\partial u_2}{\partial z} + \frac{\partial u_2}{\partial z} \right]$	$+ \frac{\partial w_2}{\partial x} \bigg] = -\frac{\partial T}{\partial x}$
$\left p_1 - 2\rho_1 \nu_1 \left[\frac{\partial w_1}{\partial z} \right] - p_2 + 2\rho_2 \nu_2 \right $	$\left[\frac{\partial w_2}{\partial z}\right]$
+ [ρ_2 -	$-\rho_1]g\eta = T_0\frac{\partial^2\eta}{\partial x^2}$

Mathematical modelling

Rheological characterization of complex fluids



End user: People working on Marine weather forecasting, Earth system modeling, Coastal engineering and Oceanographic studies Project funded by: SERB



Research Activities in Solid Mechanics



Dynamics and Vibrations Research Activities

Physics-based digital twin for automotive brakes

- Nonlinear mathematical model for drum brake
- Subscale laboratory experiment
- Machine learning techniques for health monitoring, prediction and fault diagnostics



End user: Automotive Industry Project funded by: SERB



Dynamics and acoustics of combined rolling-sliding

contact systems

- Analytical study of cam-follower system
- Controlled experiment with acoustic measurement
- Efforts to minimize vibrations and noise



End user: Automotive Industry Project funded by: IIT Tirupati

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Biomechanics of human movement

- Simplified mathematical models to explain the movement process
- Experimental extraction of dynamic parameters



End user: Prosthetics Sports Industry Project funded by: IIT Tirupati

Theoretical and Computational Solid Mechanics

Phase field approach for interfaceinduced phase transformations in polycrystalline solids

- Grain boundary-induced melting
- Grain boundary-induced martensitic phase transformations

Interaction between plasticity and martensitic phase transformations in polycrystalline solids

- Development of a continuum model
- Development of nonlinear finite element formulation and implementation of the code



End user: Materials research industries Project funded by: IIT Tirupati



Project funded by: SERB

Computational Solid Mechanics Research Activities

Impact behavior of Auxetic Materials

- Study of sandwich structures with auxetic cores under impact loading
- Development of homogenized model



Study of shape optimized structures



• Development of closed-from analytical solutions for stress-distribution in tapered beams

End user: Aerospace/ship building industry Project funded by: IIT Tirupati

End user: Aerospace/ship building industry Project funded by: IIT Tirupati



Faculty details (https://iittp.ac.in/people/faculty/mechanical-engineering-department)

Solid Mechanics and Design



Prof. N.N. Kishore



- Dr. Anup Basak
- Dr. Sriram Sundar
- Dr. P. Venkataraman



Dr. A. Madan Mohan Dr. E. Anil Kumar





Dr. Balaji Subramanian





Dr. D. Subbareddy









Fluids and Thermal

Dr. D.V. Kiran

Dr. Ajay Kumar

