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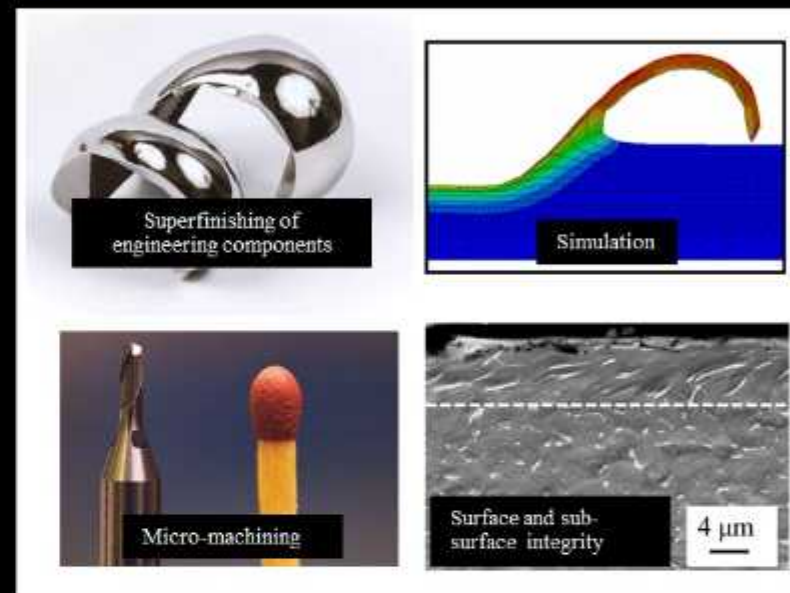


Major Areas of Research/Up to 3 major sponsored projects

- ❖ Superfinishing
- ❖ Subtractive manufacturing (micro and macro)
- ❖ Hybrid manufacturing (additive + subtractive)
- ❖ Numerical modelling of manufacturing processes

Major Research Facilities in the Group

- ❖ Shape adaptive grinding facility (under installation)
- ❖ Micro-machining set-up (under installation)
- ❖ Workstation for computational work



Technology/Product Developed/Up to 3 most significant Publications

- ❖ Naskar, Anirban, and S. Paul. "Non-destructive measurement of grinding-induced deformation-depth using grazing incidence X-ray diffraction technique." NDT & E International 126 (2022): 102592.
- ❖ Naskar, Anirban, Amit Choudhary, and S. Paul. "Wear mechanism in high-speed superabrasive grinding of titanium alloy and its effect on surface integrity." Wear 462 (2020): 203475.
- ❖ Naskar, Anirban, Biddu Bhushan Singh, Amit Choudhary, and S. Paul. "Effect of different grinding fluids applied in minimum quantity cooling-lubrication mode on surface integrity in cBN grinding of Inconel 718." Journal of Manufacturing Processes 36 (2018): 44-50.



భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
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Name of the Faculty: Ankush Kumar Jaiswal



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Major Areas of Research/Up to 3 major sponsored projects

Human exposure to extreme heat, water harvesting, adsorption chiller, multi-phase systems, wetting and texturing, sustainable refrigeration and air conditioning, solar energy systems, and thermal management of engineering systems

Major Research Facilities in the Group

Under planning phase

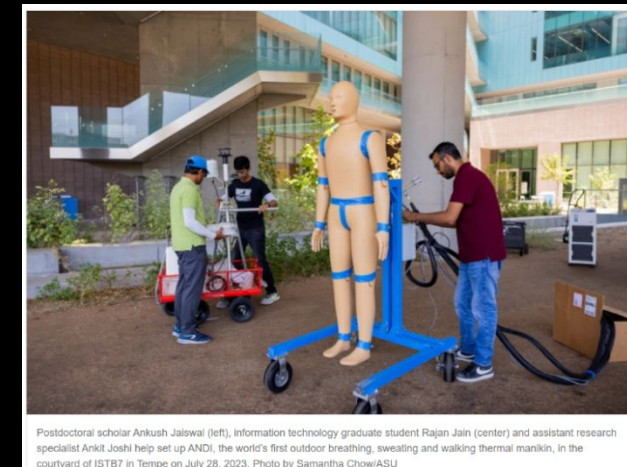
Technology/Product Developed/Up to 3 most significant

Publications

A. K. Jaiswal, et al., "Microscale Imaging and Sweat Evaporation Rate Measurement using Wind Tunnel inspired Ventilated Capsule" iScience 2024

A. K. Jaiswal, et al. "Evaporative cooling and sensible heat recovery enable practical waste-heat driven water purification" Desalination 2024

A. K. Jaiswal, et al. "Influence of cycle time and collector area on solar-driven adsorption chillers" Solar Energy 2016



Anurup Datta

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Major Areas of Research/Up to 3 major sponsored projects

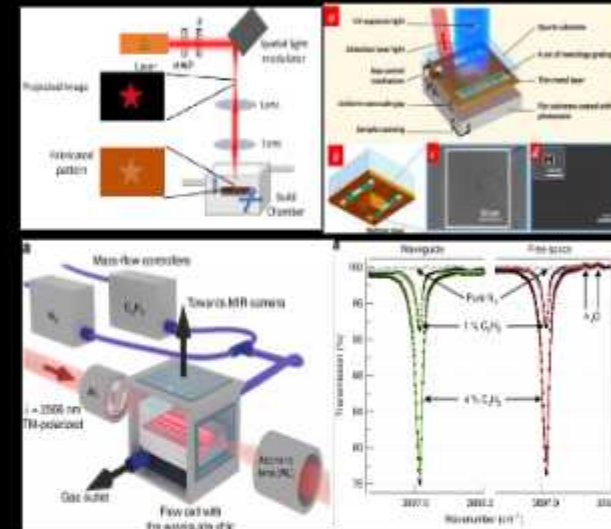
- Laser based manufacturing, particularly in the nano/micro/meso scale domain (DST project)
- Process monitoring of manufacturing processes
- Infrared optical sensing

Major Research Facilities in the Group

- Nanosecond pulsed laser (1064 nm, pulse energy 1 mJ)
- Spatial light modulator
- Optical and Optomechanical components

Technology/Product Developed/Up to 3 most significant Publications

- Wen, X., Datta, A., Traverso, L. M., Pan, L., Xu, X., & Moon, E. E. (2015). High throughput optical lithography by scanning a massive array of bowtie aperture antennas at near-field. *Scientific Reports*, 5(1), 1-6.
- Vlk, M., Datta, A., Alberti, S., Yallew, H. D., Mittal, V., Murugan, G. S., & Jágerská, J. (2021). Extraordinary evanescent field confinement waveguide sensor for mid-infrared trace gas spectroscopy. *Light: Science & Applications*, 10(1), 1-7.
- Dutta, S., Datta, A., Chakladar, N. D., Pal, S. K., Mukhopadhyay, S., & Sen, R. (2012). Detection of tool condition from the turned surface images using an accurate grey level co-occurrence technique. *Precision Engineering*, 36(3), 458-466.



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Major Areas of Research/Up to 3 major sponsored projects

- MEMS based Sensors and Actuators
- Vehicle Dynamics
- Linear and Nonlinear Vibration

Major Research Facilities in the Group

- Microsystem Laser Vibrometer
- Laser Vibrometer and Accelerometers
- Tire Tekscan System



Technology/Product Developed/Up to 3 most significant Publications

- MEMS accelerometer and gyroscope
- Higher order transient tire model and tire characterization setup
- Improved bolted joint model and bolted joint setup



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Badarinath Karri

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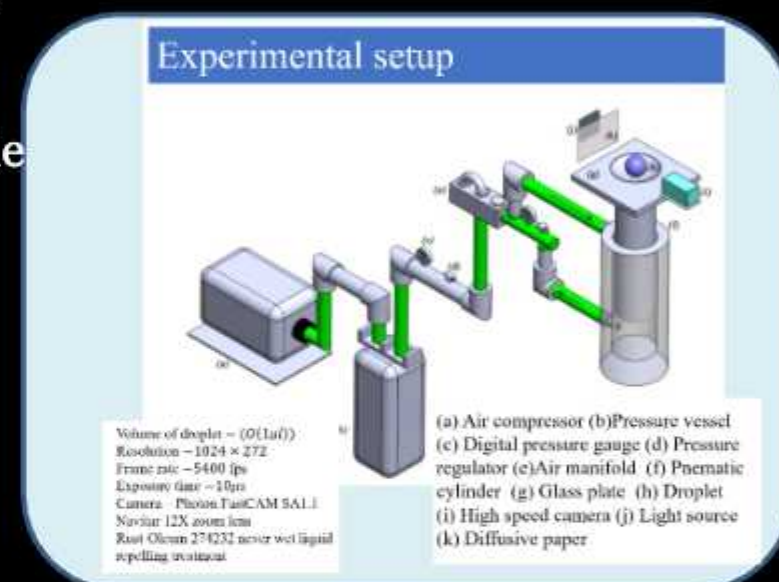


Major Areas of Research/Up to 3 major sponsored projects

1. Experimental studies on bubble dynamics – rising bubble dynamics and characterization of sprays from bubble induced impinging jets (SERB-ECR)
2. Study of cavitation bubble induced vortex rings and bubble behaviour between curved boundaries (SERB-CRG)

Major Research Facilities in the Group

1. High speed camera (Photron SA-Z)
2. Rheometer – Rheolab QC (Anton Paar)
3. Digital delay generator (Berkeley Nucleonics)
4. Lenses and other imaging accessories



Technology/Product Developed/Up to 3 most significant Publications

1. M. Agrawal, R. K. Katiyar, **B. Karri**, K. C. Sahu, “Experimental investigation of a nonspherical water droplet falling in air”, Physics of Fluids vol. 32 (11), 112105, **2020**, American Institute of Physics (AIP) publications. (Editor's pick article)
2. Y. S. Kannan, **B. Karri**, K. C. Sahu, “Entrapment and interaction of an air bubble with an oscillating cavitation bubble”, Physics of Fluids vol. 30 (4), 041701, **2018**, American Institute of Physics (AIP) publications.
3. D. M. Sharaf, A. R. Premlata, M. K. Tripathi, **B. Karri**, K. C. Sahu, “Shapes and paths of an air bubble rising in quiescent liquids”, Physics of Fluids vol. 29 (12), 122104, **2017**, American Institute of Physics (AIP) publications.



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Major Areas of Research/Up to 3 major sponsored projects

1. Material Behavior Under Extreme Environment
2. Nano/Micro-scale Experimental Mechanics
3. Computational Mechanics, Multiphysics Modeling
4. Impact, Shock, Spallation, Fracture, Fatigue, Damage
5. Composites, Superalloys, Multifunctional Materials

Major Research Facilities in the Group

1. Multi-point, Real-time, In-situ Polarized Raman Spectroscopy (under installation)
2. Computational Mechanics, Modeling, and Design Framework
3. *In-house* Developed FEM, Peridynamics, and MPM Software



Technology/Product Developed/Up to 3 most significant Publications

1. Prakash C., and Ghosh, S., 2022, A self-consistent homogenization framework for dynamic mechanical behavior of fiber reinforced composites, *Mechanics of Materials*, Vol. 166, 104222. [doi](#)
2. Prakash, C., Gunduz, I. E., and Tomar, V., 2019, Simulation-Guided Experimental Interface Shock Viscosity Measurement in an Energetic Material, *Modelling and Simulation in Materials Science and Engineering*, Vol. 27 (8), 085003. [doi](#)
3. Prakash, C., Gunduz, I. E., Oskay, C., and Tomar, V., 2018, Effect of interface chemistry and strain rate on particle-matrix delamination in an energetic material, *Engineering Fracture Mechanics*, Vol. 191, pages 46-64. [doi](#)



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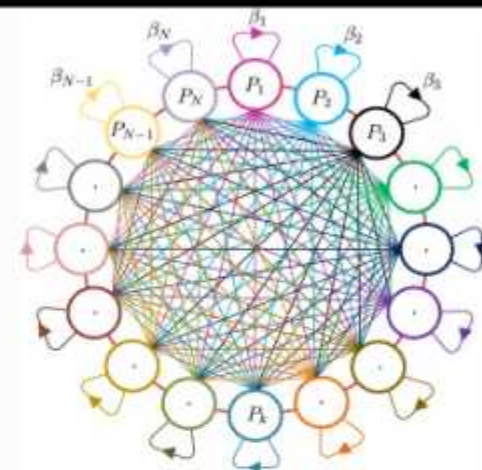
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Major Areas of Research/Up to 3 major sponsored projects

- Nonlinear dynamics
- Time delayed systems
- Multibody dynamics
- Inverse problems

Major Research Facilities in the Group

- Computational facilities
- Falcon haptic device
- Quanser 3-DoF hover
- Simple test setups for testing controllers



A dense population network model studied for understanding pandemic progression

Technology/Product Developed/Up to 3 most significant Publications

1. J. Shaik, T. Uchida, and C.P. Vyasarayani, "Effect of delay on control of direct resonance of ships in beam waves using a proportional–derivative controller with delay", ASME Journal of Computational and Nonlinear Dynamics, 17(6): 061004, 2022.
2. S. S. Kandala, T. Uchida, and C.P. Vyasarayani, "Pole placement for delay differential equations with time-periodic delays using Galerkin approximations", ASME Journal of Computational and Nonlinear Dynamics, 16(9), 091007 2021.
3. C.P. Vyasarayani and A. Chatterjee, "Complete dimensional collapse in the continuum limit of a delayed SEIQR network model with separable distributed infectivity", Nonlinear Dynamics, 101, 1653–1665, 2020. [publisher: Springer]



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Major Areas of Research/Up to 3 major sponsored projects

Tailoring of composite structures, Fiber placement techniques, Nonlinear mechanics, Nondestructive evaluation

Major Research Facilities in the Group

Autoclave for composite fabrication, Tajima Fiber placement machine, Immersion, Air coupled and Phased array ultrasonic system



Technology/Product Developed/Up to 3 most significant Publications

L B Andraju, G Raju, Damage characterization of CFRP laminates using acoustic emission and digital image correlation: Clustering, damage identification and classification, Engineering Fracture Mechanics, 2022.

S Mehta, G Raju, P Saxena, Wrinkling as a mechanical instability in growing annular hyperelastic plates, Intl Journal of Mechanical Sciences, 2022.



LSS Pillasrsetti, G Raju, Anandamurugan, Sectorial Plane Wave Imaging for Ultrasonic Array-Based Angle Beam Inspection, Journal of Nondestructive evaluation, 2021.



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Major Areas of Research/Up to 3 major sponsored projects

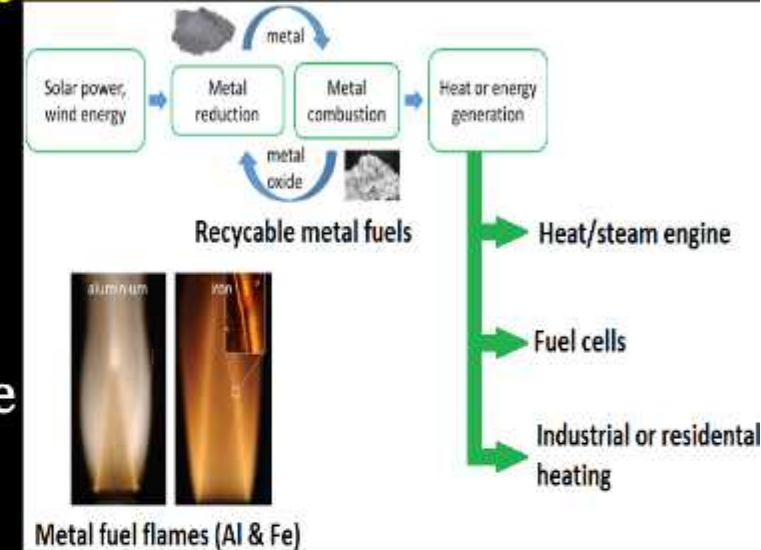
- Combustion and hydrolysis of metal fuel particles for clean recyclable energy
- Solid rocket propellants and their performance
- Development of pyroelectric solid propellants (PSPs)

Major Research Facilities in the Group

- Laminar Bunsen-type metal fuel burner with particle dispersion & measurement system
- Windowed strand burner for solid propellant burning rate measurements
- NI data acquisition systems for pressure and temperature measurements

Technology/Product Developed/Up to 3 most significant Publications

- K. Gnanaprakash, J.J. Yoh, Understanding the pyroelectric combustion behaviour of metallized electrically controlled solid propellants, Proceedings of the Combustion Institute, 2022 (*in press*)
- K. Gnanaprakash et. al, Investigation of aging induced processes on thermo-kinetic and combustion characteristics of tungsten pyrotechnic delay composition, Combustion and Flame, 228, 2021, 114-127
- K. Gnanaprakash et. al, Combustion mechanism of composite solid propellant sandwiches containing nano-aluminium, Combustion Flame, 182, 2017, 64-75



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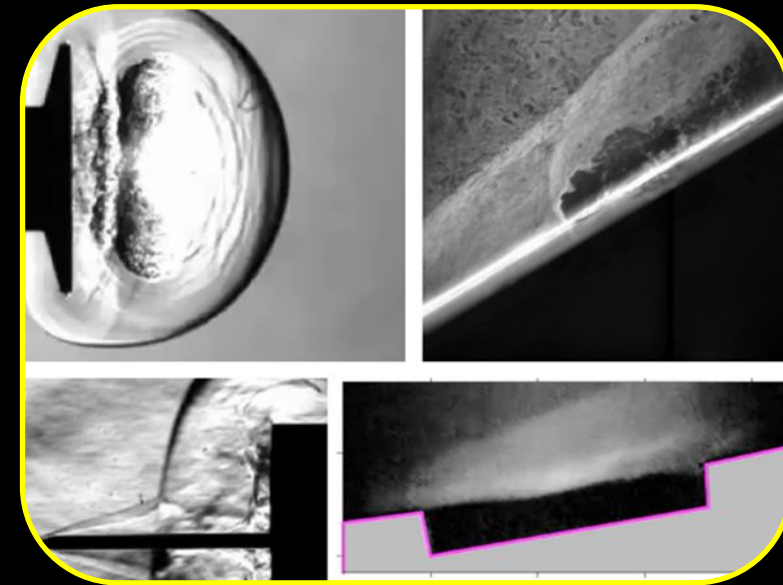


Major Areas of Research/Up to 3 major sponsored projects

1. Experimental Gas Dynamics, 2. Jet Aeroacoustics, 3. Hypersonic Aerothermodynamics, 4. Optical Flow Diagnostics, 5. Fluidic/Energy-Conversion Devices
1. Deep sub-cavity in an open cavity flow in a compressible flow regime. (JICA)
2. Investigation of end-wall acoustic loading on a deep duct in transonic cavity. (DRDO-DRDL)
3. Design and development of an arc jet plasma facility for erosion testing (DRDO-ASL)

Major Research Facilities in the Group

1. 4" X 4": Transonic Tunnel ($0.3 < M < 1.1$), time – 10 s (under construction)
2. 4" X 4": Supersonic Tunnel ($1.5 < M < 3.0$), time – 5 to 10 s (under construction)
3. 4" X 4": Hypersonic Tunnel (free jet/test-section $5 < M < 8$), time – 10 ms (under construction)
4. 50 kW Plasma Torch (under construction)



Technology/Product Developed/Up to 3 most significant Publications

1. SK Karthick, Soumya R Nanda, J Cohen: Unsteadiness in hypersonic leading-edge separation. Experiments in Fluids; 12/2022; 64(1):13; Impact Factor: 2.790
2. S Janardhanraj, SK Karthick, A Farooq: A review of diaphragmless shock tubes for interdisciplinary applications. Progress in Energy and Combustion Science; 10/2022; 93(1):101042; Impact Factor: 35.34
3. SK Karthick: Shock and shear layer interaction in a confined supersonic cavity flow. Physics of Fluids; 06/2021; 33(6):066102; Impact Factor: 3.514 (Invited Paper)

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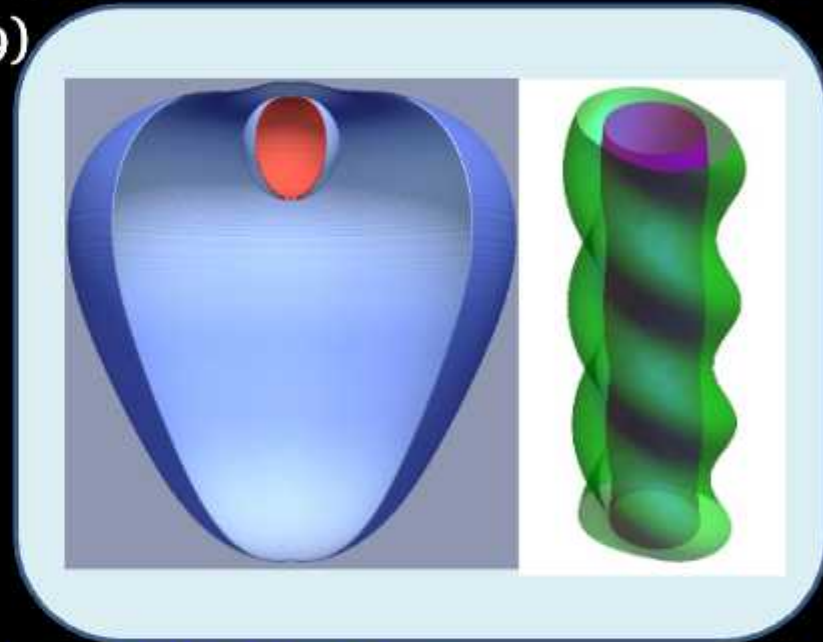


Major Areas of Research/Up to 3 major sponsored projects

- Interfacial Fluid Mechanics (PI:G446 and Co-PI:G421)
- Stability of vortices and vortex dynamics (PI:G289)
- Electrohydrodynamics (Co-PI:G311)

Major Research Facilities in the Group

- Contact angle meter
- High-speed PIV system



Technology/Product Developed/Up to 3 most significant Publications

- Joy, Nikhita, *et al.* Chem. Engg. Sci. 230 (2021): 116200.
- Sharma, Praveen K., and Harish N. Dixit. J. Fluid Mech. 908 (2021).
- Choudhury, Anjishnu, *et al.* Phys. Rev. E 103.1 (2021): 013108.



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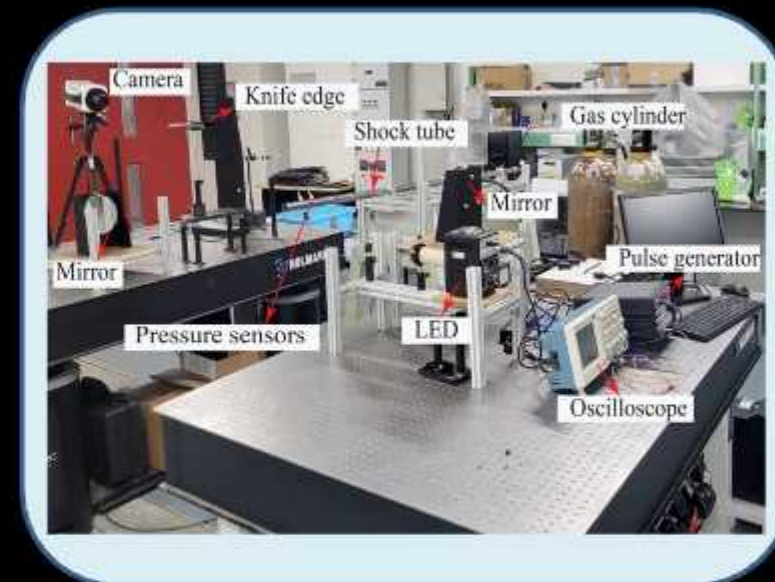


Major Areas of Research/Up to 3 major sponsored projects

- 1) Supersonic flows and blast waves
- 2) Optical-flow diagnostic tools
- 3) Multi-phase flows: oil spills (SRG)

Major Research Facilities in the Group

- 1) Shock tube facility with high-speed schlieren
- 2) Wind tunnel for aerodynamic testing
- 3) Digital-inline holography-particle size measurements



Technology/Product Developed/Up to 3 most significant Publications

- 1) Poudel, S., Chandrala, L., Das, D., & De, A. (2021). Characteristics of shock tube generated compressible vortex rings at very high shock Mach numbers. *Physics of Fluids*, 33(9), 96105.
- 2) Xue, X., Chandrala, L. D., & Katz, J. (2021). Flow structure and turbulence in the near field of an immiscible buoyant oil jet. *Physical Review Fluids*, 6(2), 24301.
- 3) Someshwar Sanjay Ade, Pavan Kumar Kirar, Lakshmana D Chandrala, K C Sahu. Droplet size distribution in a swirl airstream using in-line holography technique. *J. Fluid Mech.* (2022)



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Major Areas of Research/Up to 3 major sponsored projects

- Aeroacoustics
- Vibroacoustics
- Aeroelasticity

Major Research Facilities in the Group

- Computation cluster with CFD++ software
- Blow down high speed jet

Technology/Product Developed/Up to 3 most significant Publications

- Rotation-Induced Geometrical Stiffening of a Tapered, Pretwisted Blade (2022) L Hoskoti, S S. Gupta, Mahesh M. Sucheendran AIAA Journal
- Frequency lock-in during vortex induced vibration of a rotating blade (2018) L Hoskoti, A Misra, Mahesh M Sucheendran Journal of Fluids and Structures
- Coupled structural-acoustic response of a duct-mounted elastic plate with grazing flow (2014) Mahesh M Sucheendran, DJ Bodony, PH Geubelle AIAA journal



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Major Areas of Research/Up to 3 major sponsored projects

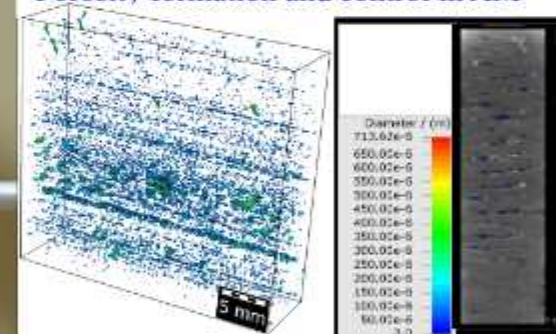
- Additive Manufacturing
- Laser Material Processing
- Process monitoring and control
- Joining: Solid state and fusion welding

Major Research Facilities in the Group

- Metal additive manufacturing: WAAM, L-DED and L-PBF
- Lasers: High Power CW Lasers and Q-switched Nd:YAG Laser
- 40 kN Friction Stir Welding System
- XRD Residual Stress Measurement System
- Scanning electron Microscope
- Hardness tester



Porosity formation and control in AM



Technology/Product Developed/Up to 3 most significant Publications

- Ashish Kumar Nath, Muvvala Gopinath, Amal M Nair, Sagar Sarkar, Real-time monitoring and control of thermal history using multiple pyrometers for laser material processing including additive manufacturing processes, (Filed, No. 202031001870)
- Arkajyoti Jha, Shivam Shukla, Amit Choudhary, Ramji Manoharan, Gopinath Muvvala, A study on developing process-structure-property relationship with molten pool thermal history during laser surface remelting of Inconel 718, Optics & Laser Technology 157 (2023) 108732. <https://doi.org/10.1016/j.optlastec.2022.108732>
- Sagar Pawar Dadasaheb, Srinath Ellaswamy Gudur, Vishwanath Nagallapati, Amit Choudhary, Arun Torris, Gopinath Muvvala, A study on anisotropy in wire arc additively manufactured Inconel 625 multi-layered wall and its correlation with molten pool thermal history, Materials Science & Engineering A 840 (2022) 142865, <https://doi.org/10.1016/j.msea.2022.142865>



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Major Areas of Research/Up to 3 major sponsored projects

Predictive modeling for Digital Fabrication

Hybrid Metal Additive Manufacturing

Analysis (Numerical as well as Experimental) of Manufacturing processes

Development of Resources Saving and Rapid Response Processes

Major Projects (PI)

- Double Sided Incremental Forming (Boeing Global, SERB)

- Development of Electric Pulse Aided Forming Processes (MoE, DHI and TATA STEEL)

- Circular Manufacturing research and educational collaboration between Norway, India and Japan

(CIRMAN), Norwegian Research Council

Major Research Facilities in the Group

Custom built 8-Axis NC Machine with Two Spindles

Custom built Pulse Generators

Custom Built Electrical Pulse Aided Material Testing Equipment

Analysis Software's

Additive Manufacturing (PBF, DED)

Technology/Product Developed/Up to 3 most significant Publications

Extruder Deposition System

Double Sided Incremental Forming

Electric Pulse Aided Bending

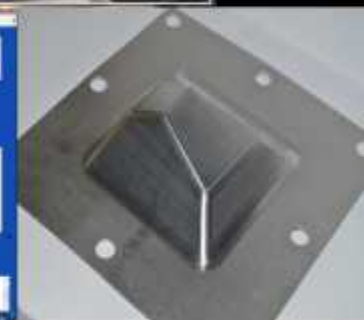
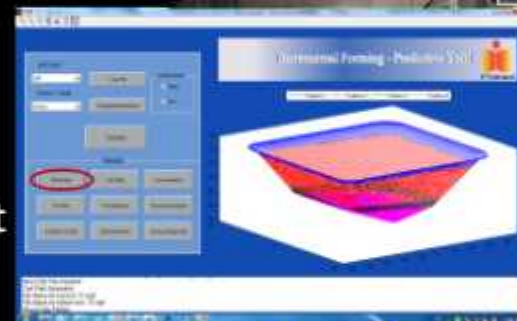
Reconfigurable Tooling Applications in Deformation and Additive Manufacturing

Publications

1. Importance of Machine Compliance to Quantify Electro-Plastic Effect in Electric Pulse Aided Testing: An Experimental and Numerical Study, SME Journal of Manufacturing Processes, 2022, V75, 268-279.

2. Tool Path Design System to Enhance Accuracy during Double Sided Incremental Forming: An Analytical Model for Predicting Compensations for Small/Large Components, SME Journal of Manufacturing Processes, 2020, V58, 510-523.

3. Optimum Part Deposition Orientation in Fused Deposition Modeling, International Journal of Machine Tools and Manufacture, 2004, V44, 585-594.



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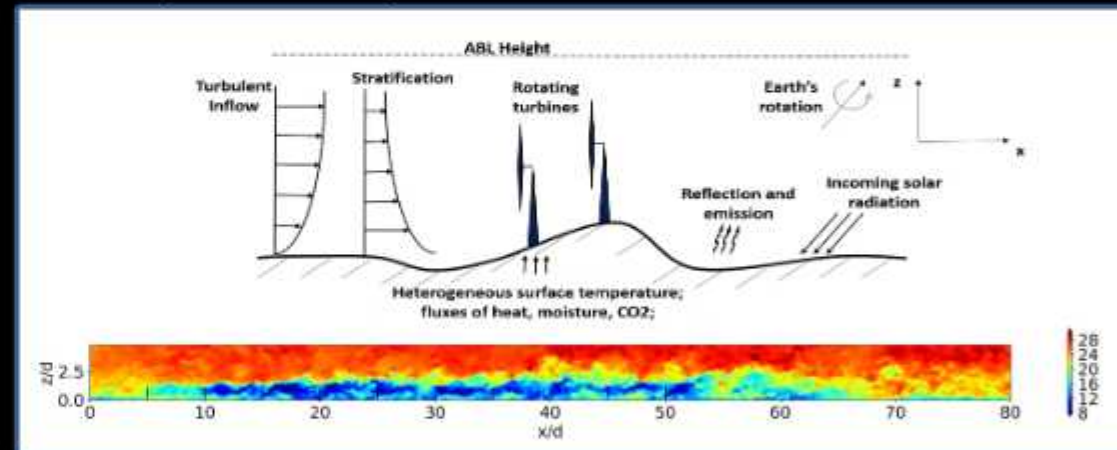


Major Areas of Research/Up to 3 major sponsored projects

1. Wind Energy; Boundary Layer Turbulence; Large Eddy Simulations; Compressible Multiphase Flows; High-Performance Computing
2. Surface roughness heterogeneity effects on wind farm performance (DST-SERB)
3. Wind farm layout assessment on complex terrain (DST-NSM)

Major Research Facilities in the Group

1. HPC Cluster (3 nodes x 48 cores, 256 GB RAM, 480 GB SSD)
2. High-end workstations for visualization



Technology/Product Developed/Up to 3 most significant Publications

1. N. N. Kethavath, K. Mondal, N. S. Ghaisas (2022): "Large eddy simulation and analytical modelling study of the wake of a wind turbine sited behind an abrupt rough-to-smooth surface roughness transition", Physics of Fluids, 34, 125117.
2. N. S. Ghaisas (2020): "A predictive analytical model for surface shear stresses and velocity profiles behind a surface roughness jump", Boundary-Layer Meteorology, 176, 349 – 368.
3. High-order accurate, highly-scalable code for wind-turbine/farm and coupled solid-fluid simulations



భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
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Pankaj Sharadchandra Kolhe

Associate Professor, Combustion and Flow

Diagnostics, Mechanical and Aerospace Engineering

Academic Block C#404.; Office Phone No. 040-2301-6665; Mobile :8333830942; psk@mae.iith.ac.in;

<https://sites.google.com/mae.iith.ac.in/pskolhe/home?pli=1>

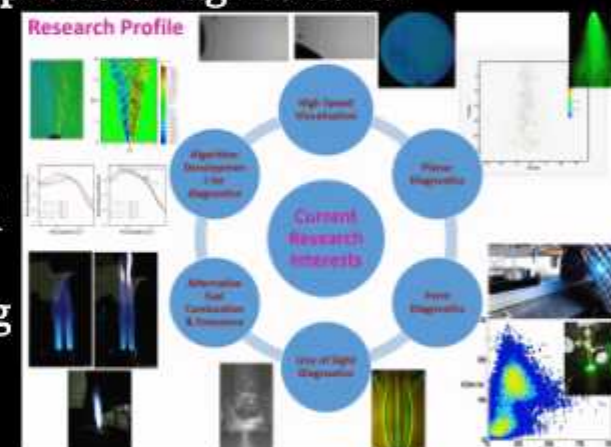


Major Areas of Research/Up to 3 major sponsored projects

- 1) Novel Flow Blurring Injector Characterization using point and planar optical diagnostic techniques. (DST/SERB project)
- 2) Experimental Investigation into the Effect of Aerodynamics Within the Primary Zone of Biofuel Operated Swirl stabilized Gas Turbine Combustor on Combustion, and Emissions Characteristics (DST/SERB project)
- 3) Development of an on-board spray controller model for UAVs using AI for precision agricultural application (DST/SERB project)

Major Research Facilities in the Group

- 1) Simultaneous OH* and HCHO* PLIF
- 2) Stereo PIV, Rainbow Schlieren Deflectometry, and Supersonic wind tunnel facility
- 3) Flat flame burner, UV and Visual range intensified cameras, SLIPI Imaging and LII diagnostic setup



Technology/Product Developed/Significant Publications

- 1) Biswal, Abinash; Kale, Rakesh; Balusamy, Saravanan; Banerjee, Raja; **Kolhe, Pankaj**; "Lemon peel oil as an alternative fuel for GDI engines: A spray characterization perspective," *Renewable Energy*, **142**, 249-263, 2019.
- 2) Soni, Surendra Kumar; Kirar, Pavan Kumar; **Kolhe, Pankaj**; Sahu, Kirti Chandra; "Deformation and breakup of droplets in an oblique continuous air stream," *International Journal of Multiphase Flow*, **122**, 103141, 2020.
- 3) Biswal, Abinash; Kale, Rakesh; Teja, Golakoti Ravi; Banerjee, Sayak; **Kolhe, Pankaj**; Balusamy, Saravanan; "An experimental and kinetic modeling study of gasoline/lemon peel oil blends for PFI engine," *Fuel*, **267**, 117189, 2020



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C-213.; Office Phone No:04023016681; pkumar@mae.iith.ac.in; prabhatkumarrns.wixsite.com/pkumar



Major Areas of Research/Up to 3 major sponsored projects

Multi-disciplinary/-physics/-scale topology optimization

Compliant mechanisms

Soft robots

Inverse problems

Computational contact and solid mechanics

Major Research Facilities in the Group

1. In-house code for topology optimization of contact-aided compliant mechanisms

2. In-house codes for 2D&3D topology optimization

3. 3D-Printer

4. Educational codes for topology optimization

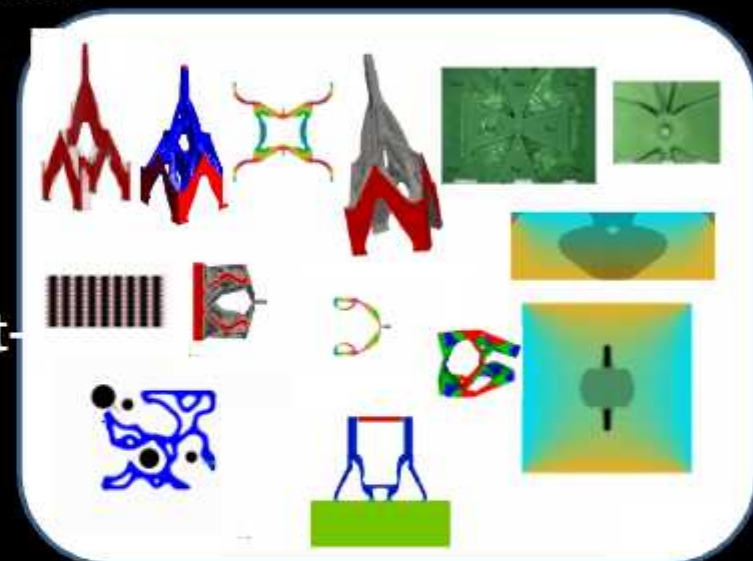
Technology/Product Developed/Up to 3 most significant Publications

1. P. Kumar: Topology optimization of stiff structures under self-weight for given volume using a smooth Heaviside function, Struct Multidisc Optim 65 (4), 1-17, 2022.

2. P Kumar, C Schmidleithner, NB Larsen, O Sigmund: Topology optimization and 3D printing of large deformation compliant mechanisms for straining biological tissues, Struct Multidisc Optim 63 (3), 1351-1366, 2021

3. P Kumar, M Langelaar: On topology optimization of design of pressure-loaded three-dimensional structures and compliant

Int J Numer Meth Eng 122(9):2205–2220



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Major Areas of Research/Up to 3 major sponsored projects

Atomistic simulations and continuum modeling of nanostructures, constitutive modeling, piezoelectric materials, flexoelectric materials (sensors/actuators), metamaterials, biomechanics (growth in soft tissues and cancerous tumor), computational solid mechanics Finite Element Analysis.

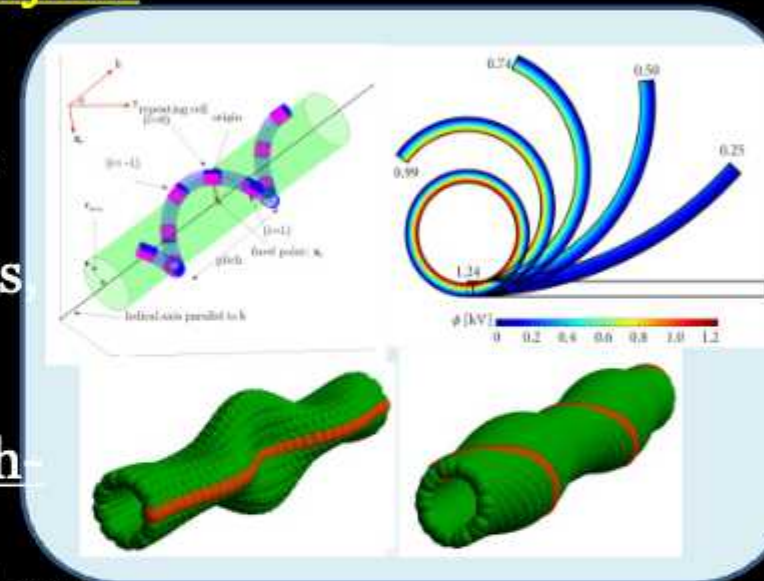
Major Research Facilities in the Group

SUCSHM (Searching Unique Class of Small-scale High-performance Materials) Lab:

Computational Lab equipped with high-end workstations.

Technology/Product Developed/Up to 3 most significant Publications

1. Codony, D., Gupta, P., Marco, O. and Arias, I., 2021. Modeling flexoelectricity in soft dielectrics at finite deformation. *Journal of the Mechanics and Physics of Solids*, 146, 104182.
2. Gupta, P. and Kumar, A., 2019. Effect of surface elasticity on extensional and torsional stiffnesses of isotropic circular nanorods. *Mathematics and Mechanics of Solids*, 24(6), 1613-1629.
3. Gupta, P. and Kumar, A., 2017. Effect of material nonlinearity on spatial buckling of nanorods and nanotubes. *Journal of Elasticity*, 126(2), 155-171.



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R Prasanth Kumar

Professor, Robotics and Intelligent Systems Lab, MAE Department

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Major Areas of Research/Up to 3 major sponsored projects

Legged robots – biped, humanoid, quadruped
Quadcopter/UAV, swarms
Flexible manipulators
Reinforcement learning for robot locomotion

Major Research Facilities in the Group

3D Lidar



Technology/Product Developed/Up to 3 most significant Publications

Krishna Prakash Yadav and R Prasanth Kumar,
"Biped dynamic walker modeling and control for
underactuated gait cycle," International Journal of
Dynamics and Control, pp 1-10, 2021



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Raja Banerjee

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Sponsored Projects

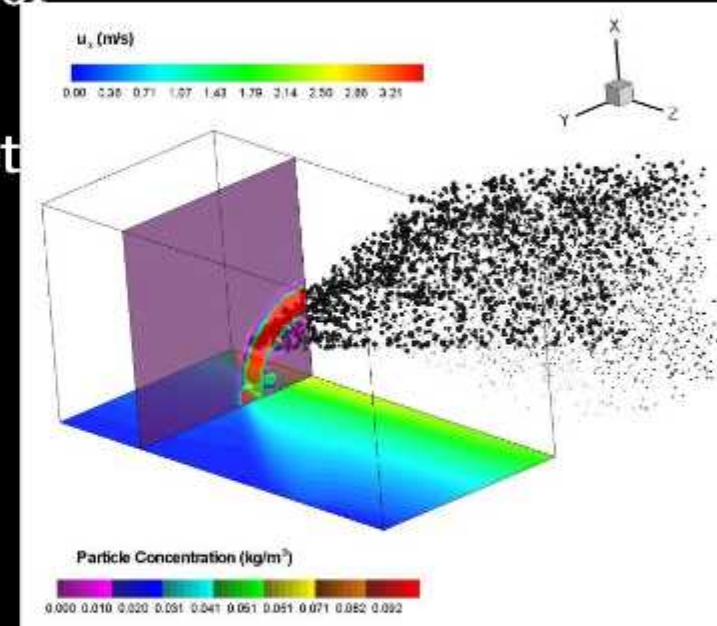
1. Development of an on-board spray controller model for UAVs using AI for precision agricultural
2. Experimental and Numerical Investigation of Doublet Jet-on-Jet Impinging Atomizer

Major Research Facilities in the Group

1. Spray Visualization & Characterization Setup
2. Spray and Combustion Modelling capabilities

Publications

1. Kant, K. & Banerjee, R. Study of the secondary droplet breakup mechanism and regime map of Newtonian and power law fluids at high liquid–gas density ratio. *Phys. Fluids* 34, 43108 (2022)
2. Kale, R. & Banerjee, R. Experimental investigation on GDI spray behavior of isooctane and alcohols at elevated pressure and temperature conditions. *Fuel* 236, 1–12 (2019).



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Ranabir Dey

Assistant Professor, Soft Matter and Microswimmers Group,
Department of Mechanical and Aerospace Engineering

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Major Areas of Research/Up to 3 major sponsored projects

- Active soft matter (dynamics and collective behaviour of self-propelling microswimmers)
- Capillarity and wetting phenomena
- Low Reynolds number hydrodynamics

(Funding: SERB SRG Grant no. SRG/2021/000892)

Major Research Facilities in the Group

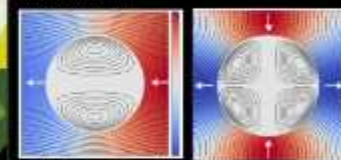
- Soft lithography unit for microfluidics (sonicator, spin coater, plasma cleaner, hot air oven)
- Dual-channel fluorescence microscopy

3 most significant Publications

- **Dey, R. ***, Bunes, C. M., Hokmabad, B. V., Jin, C., & Maass, C. C. * (2022). Oscillatory rheotaxis of artificial swimmers in microchannels. *Nature communications*, 13(1), 1-10. (Selected as Editor's highlight under Applied Physics and Mathematics) (*corresponding author)
- Hokmabad, B. V., **Dey, R.**, Jalaal, M., Mohanty, D., Almukambetova, M., Baldwin, K. A., ... Maass, C. C. (2021). Emergence of bimodal motility in active droplets. *Physical review X*, 11(1), 011043.
- Baratian, D.#, **Dey, R.#**, Hoek, H., Van Den Ende, D., & Mugele, F. (2018). Breath figures under electrowetting: electrically controlled evolution of drop condensation patterns. *Physical review letters*, 120(21), 214502. (# Joint first authors)



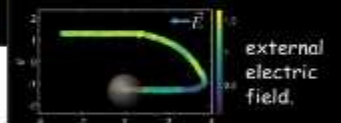
Adaptation of self-propelling droplet microswimmers to external cues, like ...



Ambient viscosity,



external flow,



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Department of Mechanical and Aerospace Engineering

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Major Areas of Research/Up to 3 major sponsored projects

Turbulence Modeling

Bluff Body Theory

Jets

Reduced order modeling

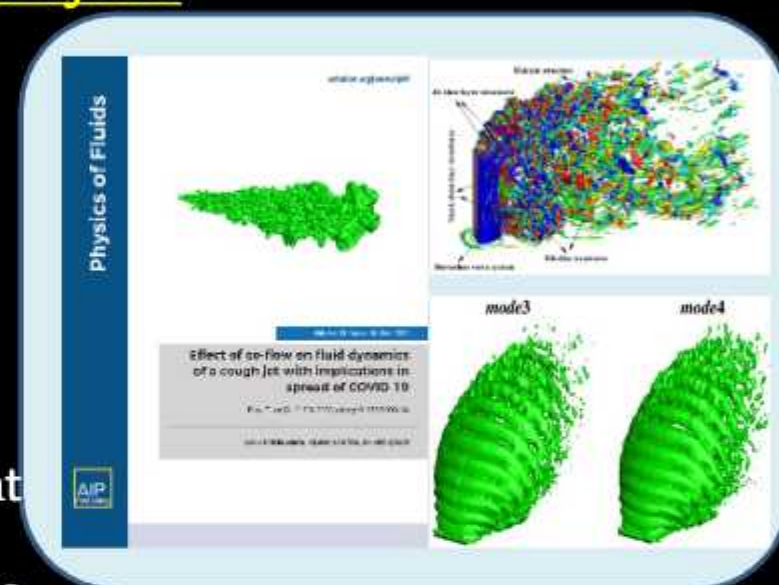
Flow control

Major Research Facilities in the Group

1. 3D-Unsteady-Incompressible Finite Difference based in-house code to simulate Turbulent flows (DNS and LES)
2. 3D-Unsteady-Incompressible Finite Volume code. The code is for a structured grid but does account for grid non-orthogonality.
3. HPC (NSM)

Technology/Product Developed/Up to 3 most significant Publications

1. Sachidananda Behera and Arun K Saha, 2019, "Characteristics of the flow past a wall mounted finite-length square cylinder at low Reynolds number with varying boundary layer thickness", ASME. J. Fluids Eng., 141(6), 061204-17, doi: 10.1115/1.4042751
2. Sachidananda Behera and Arun K Saha, 2020 "Evolution of the flow structures in an elevated jet in crossflow", Physics of Fluids, 32, 015102, doi:10.1063/1.5129498



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Safvan Palathingal

Assistant Professor, Kappa Lab, Department

Room: C437; Office: (040) 2301 - 6674; Email: safvan@mae.iith.ac.in; Webpage: <https://safvan.github.io>

Major Areas of Research/Up to 3 major sponsored projects

Areas: Bistable structures, Compliant mechanisms, Structural optimization, Smart materials

1. Nonlinear mechanics of slender arches and shells with applications to compact pump (Toyota USA, 2020-present)
2. Analysis and design of three-dimensional connected bistable arches SERB (2021-present)

Major Research Facilities in the Group

Kappa lab in the Department of Mechanical and Aerospace Engineering with capabilities to conduct computational studies and table-top experiments.



Technology/Product Developed/Up to 3 most significant Publications

Palathingal, S. and Ananthasuresh, G. K., “Analytical modeling of spatial deformation pathways in planar and spatial shallow bistable arches”, Proceedings of the Royal Society A (2019) (<https://doi.org/10.1098/rspa.2019.0164>.)

Palathingal, S. and Ananthasuresh, G. K., “A bilateral relationship between stable profiles of pinned-pinned bistable shallow arches”, International Journal of Solids and Structures (2018). (<https://doi.org/10.1016/j.ijsolstr.2018.03.006>.)

Palathingal, S. and Ananthasuresh, G. K., “Design of Bistable Arches by Determining Critical Points in the Force-displacement Characteristic”, Mechanism and Machine Theory 117C (2017), pp. 175-188, (<https://doi.org/10.1016/j.mechmachtheory.2017.07.009>.)



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Sai Sidhardh

Assistant Professor, Department of Mechanical and Aerospace Engineering

501, Academic Block C; 040 23016676; 9593089036; sidhardh@mae.iith.ac.in; [Research Page](#)

Principal area of interest: Theoretical and Computational Solid Mechanics

Focus on:

- Applied AI/ML in solid mechanics
- Computational methods & solvers
- Multiphysics modeling and simulations
- Metastuctures design and simulation
- Applied fractional calculus

Major Research Facilities in the Group

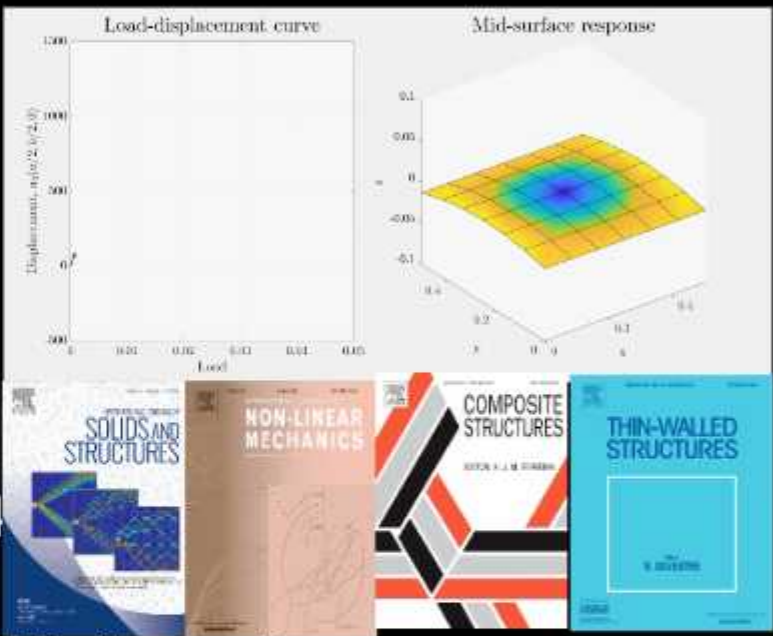
Resources: Workstations (2 Nos.): Intel C621, 20C/4
Nvidia T1000 4GB GDDR6

Softwares: MATLAB, ABAQUS, COMSOL, LS-Dyna, Mathematica

Publications (Updated list at [Google Scholar](#))

- Journal of Applied Mechanics 88.4 (2021)
- International Journal of Solids and Structures 202 (2020): 398-417
- Acta Mechanica 229.7 (2018): 2765-2786

Sponsored Projects



• Damage and Fracture modeling; Computational Methods; Data-driven techniques

Honeywell Data-driven techniques; Computational Solid Mechanics



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Saravanan BALUSAMY

Associate Professor, Combustion Lab, Mechanical and Aerospace Engineering

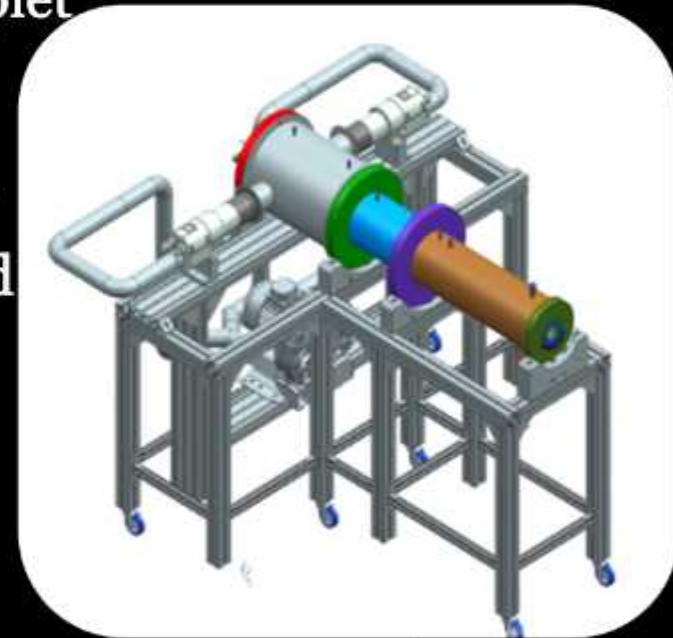
90-9701582561; saravananb@mae.iith.ac.in; <https://people.iith.ac.in/saravananb/>

Major Areas of Research

Advanced Laser Diagnostics for Combustion and Spray Studies
Alternative Fuels for Internal Combustion Engines and Gas Turbines
Experimental Investigation of Fluid Mechanics and Droplet Evaporation

Major Research Facilities in the Group

Hydrogen Fuel Flexible Burner System – 1 MW to 5 MW
Swirl Stabilized Turbulent Burners – Premixed/Stratified
Stereo-PIV, OH-PLIF, HCHO-PLIF, OH*/CH*, High-speed IRO, PI-Max -4 ICCD, Screw Compressor, Flow bench



Technology/Product Developed

Sellan, D., Balusamy, S. Aerospace Science and Technology, 120, 107253 (2022).
Nayak, G.M., Kolhe, P. & Balusamy, S. Flow Turbulence Combust 108, 1069–1087 (2022).
Sellan, D., Balusamy, S. Experimental Thermal and Fluid Sc 121, 110281 (2021).



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Major Areas of Research/Up to 3 major sponsored projects

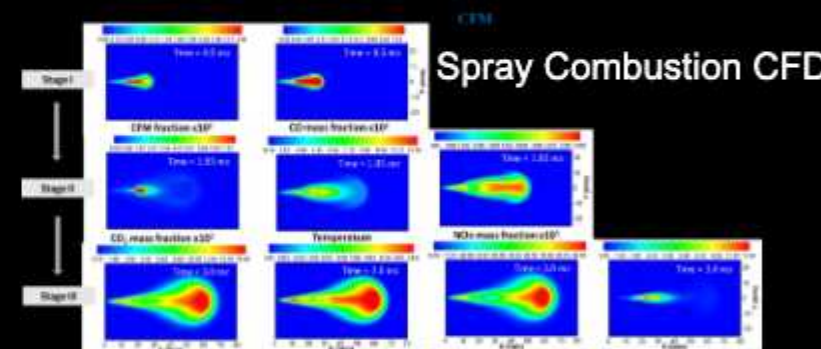
- 1) Biomass gasification for generation of hydrogen (DST project)
- 2) CFD and Chemical Kinetic Modelling of Endothermic Fuel cooling in hypersonic engine systems (DRDL project)
- 3) Chemical Kinetics of Hydrogen, Ammonia and Biofuel combustion and emissions in IC Engines

Flat Flame Burner System



Major Research Facilities in the Group

- 1) Flat Flame Burner systems with Gas Chromatogram and Spectroscopic Detectors
- 2) HPC enabled ANSYS-FLUENT and CHEMKIN software for combustion and CFD modelling
- 3) Biomass gasification system (under installation)



Technology/Product Developed/Up to 3 most significant Publications

- 1) Wakale, A.B., Banerjee, S. and Banerjee, R., 2020. Estimation of NO_x and soot emission from a constant volume n-butanol/n-dodecane blended spray using unsteady flamelet model based on n-dodecane/n-butanol/NO_x/PAH chemistry. Journal of the Energy Institute, 93(5), pp.1868-1882.
- 2) Biswal, A., Kale, R., Teja, G.R., Banerjee, S., Kolhe, P. and Balusamy, S., 2020. An experimental and kinetic modeling study of gasoline/lemon peel oil blends for PFI engine. Fuel, 267, p.117189.
- 3) Xu, R., Wang, K., Banerjee, S., Shao, J., Parise, T., Zhu, Y., Wang, S., Movaghar, A., Lee, D.J., Zhao, R. and Han, X., 2018. A physics-based approach to modeling real-fuel combustion chemistry-II. Reaction kinetic models of jet and rocket fuels. Combustion and Flame, 193, pp.520-537.



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Professor, Manufacturing,

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Major Areas of Research

- Additive Manufacturing of Metallic Objects, particularly large sized
- Hybrid Techniques for AM (multi-process; multi-material form; multi-scale)
- Fabrication of Functionally Gradient Objects through Additive Manufacturing
- Thermal Balancing Approaches for Residual Stresses & Distortion Control
- Medical Applications of AM
- Industry 4.0 and Circular Manufacturing



Major Research Facilities in the Group

- Wire-Arc Additive Manufacturing (WAAM)
- Blown-Powder and Laser based Direct Energy Deposition (LW-DED)
- Powder Bed Fusion (PBF)
- Characterization Facilities like XRD, XRF etc



Technology/Product Developed

- Key Research Aspects:
- Machine design and development for adapting to different applications
- 5-axis tool path planning
- Thermal Management for Distortion and Residual Stress control
- Online monitoring for defect detection
- Components bigger than 500mm possible
- Suitable Applications: Marine impellers, Rocket casings and fuel tanks, die and tool repair



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Syed Nizamuddin Khaderi



Associate Professor, Department of Mechanical and Aerospace Engineering

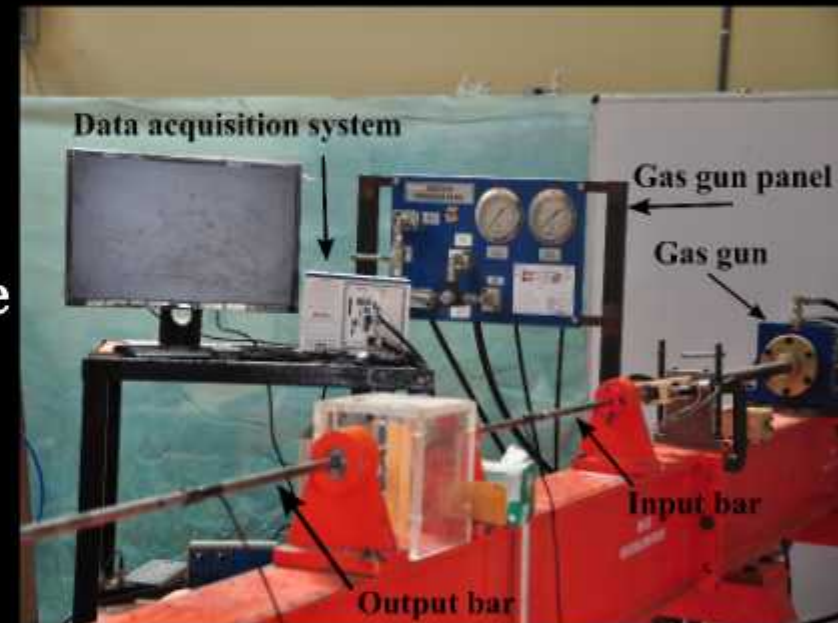
421, C-block, IITH; +91 -9177292090; snk@mae.iith.ac.in; <https://sites.google.com/site/snkhaderi/>

Major Areas of Research

Solid mechanics, impact mechanics.

Research Facilities

- Split Hopkinson bar setups for high strain rate characterization of materials.
- Underwater shock simulator.
- Drop weight impact testing machine.



Technology/Product Developed/Publications

- Split Hopkinson pressure bar for high strain rate characterization of materials.
- Underwater shock simulator.



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Assistant Professor, Nondestructive Evaluation Lab
Department of Mechanical & Aerospace Engineering



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<https://mae.iith.ac.in/faculty-directory.html#thulsiram>

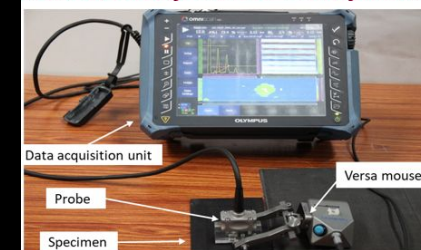
Major Areas of Research/Up to 3 major sponsored projects

Computational Methods in Nondestructive Evaluation Phased Array Ultrasound Imaging in Bulk and Guided Waves, Material Characterization, and Applied Machine Learning in NDE.

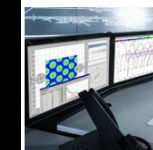
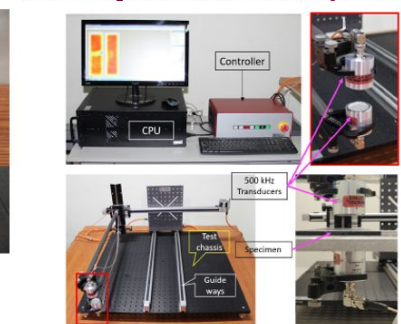
Major Research Facilities in the Group

Phased Array Ultrasonic Equipment, Air Coupled Ultrasonic System, Acoustic Emission System, Immersion Ultrasonic Scanner, High-performance Computing Facility.

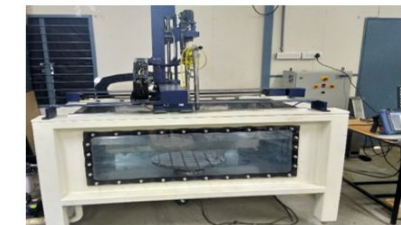
Phased Array Ultrasonics system



Air Coupled Ultrasonics system



Acoustic emission system



Immersion Ultrasonics scanner

Technology/Product Developed/Up to 3 most significant Publications

1. Thulsiram Gantala, and Krishnan Balasubramanian. System And Method for Ultrasound Imaging Using Arbitrary Virtual Array Sources of Aperture Excitation. Indian Patent: 202241060172, Date of Grant: 22/04/2024.
2. Krishnan Balasubramanian, and Thulsiram Gantala. Method and System for Generating Time efficient Synthetic Nondestructive Testing Data. Indian Patent: 202141007067, Date of Grant: 28/03/2024.
3. Thulsiram Gantala, and Krishnan Balasubramanian. "Automated defect recognition for welds using simulation assisted TFM imaging with artificial intelligence." Journal of Nondestructive Evaluation 40 (2021): 1-24.

K. Venkata Subbaiah

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Major Areas of Research/Up to 3 major sponsored projects

Computational Fluid Dynamics (CFD)

Supersonic and Hypersonic flows

Heat Transfer Enhancement Techniques

Major Research Facilities in the Group

High End Work Stations

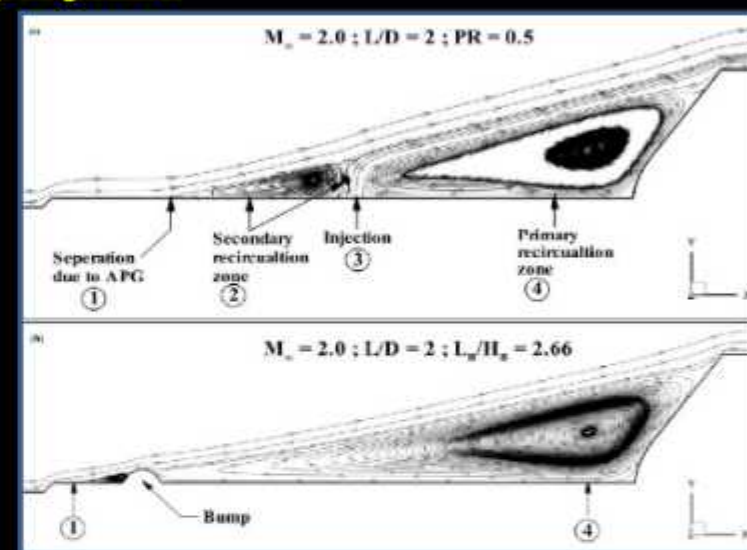
500 Teraflops Super Computing System (Institute Facility)

Technology/Product Developed/Up to 3 most significant Publications

Veeresh Tekure, Pratik Shrikanth Pophali and K. Venkatasubbaiah, “Numerical investigation of aerospike semi-cone angle and a small bump on the spike stem in reducing the aerodynamic drag and heating of spiked blunt-body: New correlations for drag and surface temperature”, Physics of Fluids, Vol 33 (11),116108:1-27, 2021mAmerican Institute of Physics publisher. (Editor’s Pick Article)

Veeresh Tekure and K. Venkatasubbaiah, “Effect of Mach number and plate thickness on the flow field and heat transfer characteristics of supersonic turbulent flow over a flat plate at different thermal boundary conditions”, European Journal of Mechanics–B/Fluids, Vol. 88, pp:160-177, 2021.

Abhijith M.S and K. Venkatasubbaiah, “Numerical investigation of jet impingement flows with different nanofluids in a mini channel using Eulerian-Eulerian two-phase method”, Journal of Thermal Science and Engineering Progress, Vol. 19, pp:100585: 1-13, 2020



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भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad



Major Areas of Research/Up to 3 major sponsored projects

- Engineering Acoustics, Sound Quality, Environmental Acoustics
- Low Noise, Energy Efficient, High rpm bearing for Electric Vehicle
- Development of low frequency noise control sheet absorber: A biomimetic solution.
- Sound Quality Analysis of Automotive Horn

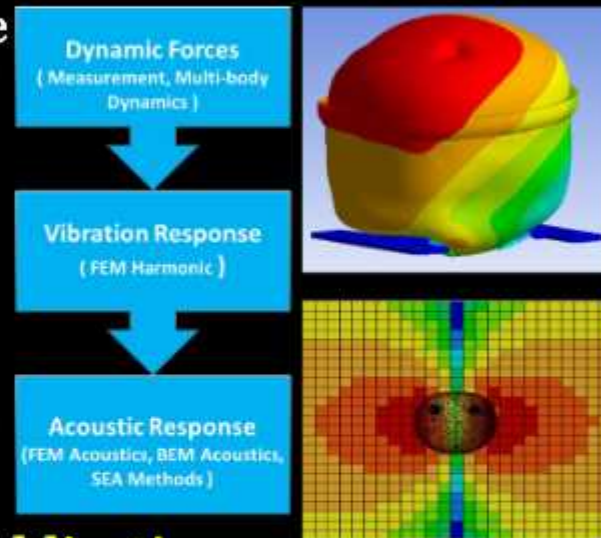
Major Research Facilities in the Group

- B&K Acoustic Camera
- B&K 2270 Class I Sound level meter
- Impedance Tube
- Digital Artificial Head Measurement System
- Linear & Torsional Laser Vibrometers

Technology/Product Developed/Up to 3 most significant Publications

- Low frequency acoustic absorber
- Basic Vibration Trainer
- High-speed Bearing Noise Tester
- Deepak C Akiwate, Mahendra D Date, B. Venkatesham and Suryakumar S, Acoustic characterization of additive manufactured perforated panel backed by honeycomb structure with circular and non-circular perforations, Applied Acoustics 155, 271-279 2019
- D Veerababu, **B Venkatesham**, Green's function approach for the transmission loss of concentrically multi-layered circular dissipative chamber, The Journal of the Acoustical Society of America 147 (2), 867-876, 2020
- ST Golla, AR Jadhav, R Banerjee, B Venkatesham, Numerical Simulation of Hit Noise Generation Due to Sloshing Phenomenon in a Rectangular Tank Under Periodic Excitation, Journal of Fluids Engineering 145 (3), 2022.

Computational Acoustic Model



Vishnu R. Unni

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Major Areas of Research

Combustion Dynamics, Nonlinear Dynamical Systems, Complex Networks, Data-driven models, Thermoacoustic Instability, Dynamics of micro aerial vehicles

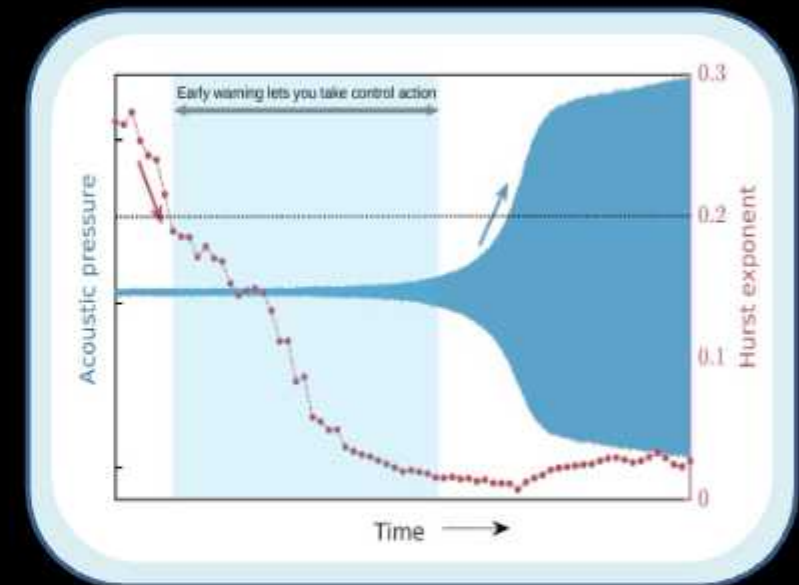
Major Research Facilities in the Group

Thermoacoustic Instability Rig, Unsteady wind generator (being developed)

Technology/Product Developed

ether-Early warning for THERmoacoustic instability, Induja P., Unni, V. R., Nair, V. & Sujith, R. I., Indian Copyright Certificate-Registration No: SW-12933/2019

Unni, Vishnu R., et al. "System and method for optimizing passive control of oscillatory instabilities in turbulent flows. U.S. Patent No. 10,895,382. 19 Jan. 2021.



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Major Areas of Research

Computational Solid Mechanics

Additive Manufacturing

Bio-Mechanics

Major Research Facilities in the Group

Bi-axial Test setup for Tissues

High Performance Computing Cluster

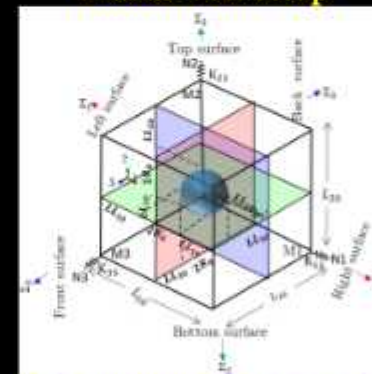
Technology/Product Developed

Ductile Failure of Metals

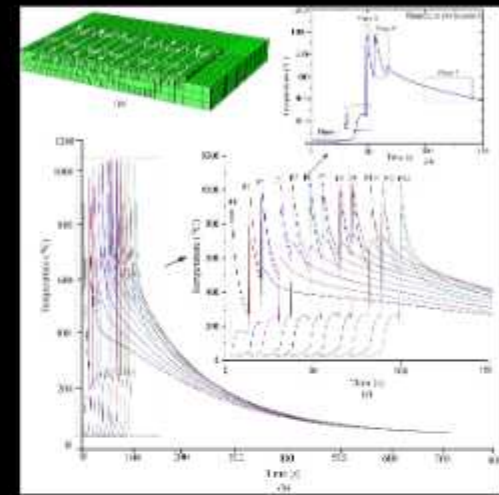
Invitro Digital Photo Elasticity Setup



Bi-axial Test setup



Ductile Fracture: RVE-Void Cell



WAAM: Additive Manufacturing



Ocular Mechanics: Invitro Digital Photo Elasticity Setup



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