भारतीय प्रौद्योगिकी संस्थान तिरुपति

TIRUPATI

Fluid and Thermal Sciences

Prof Muthukumar Palanisamy

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भारतीय प्रौद्योगिकी संस्थान तिरुपति

IIT TIRUPATI

PhD – IIT Madras, 2005 – Hydrogen Storage and Compression

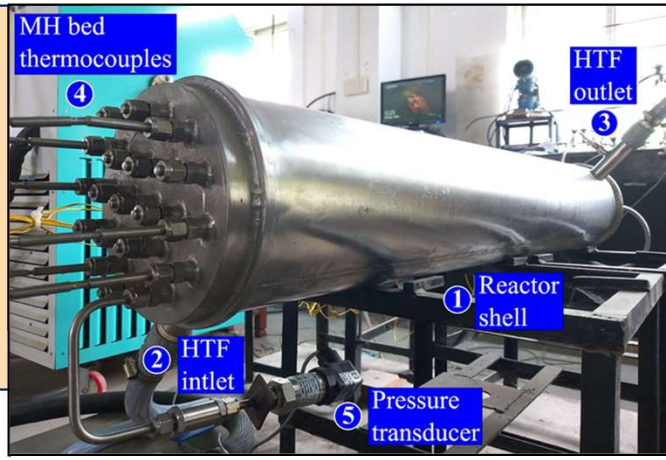
- **Areas of Specializations – Porous Medium Combustion, Hydrogen Energy –Production, purification and storage, Thermal Energy storage, Battery thermal management, Solar Drying, Waster Heat recovery, Compact heat exchangers.**
- **Academics Achievements: 450 + publications; 15 plus patents, 35 + PhD Guidance**
- **Editorial Board : Int J Hydrogen Energy, Thermal Science and Engineering Progress, Solar Energy**

Porous Radiant Burners [12 patents]

- Operated with LPG, PNG, CNG, Biogas, Hydrogen Blends
- Fuel saving up to 50 % and Reduction in emissions up to 85%
- Large operating power range 3 -100 kW
- Payback period 2-5 months (depends on power)
- Provide smoke free and clean cooking environment.

Hydrogen Storage, Purification and Compression Systems

- Integrated Hydrogen storage up to 55,000 lit and 10 kW cooling system
- Purification up to 99. 999% from 10 % purity
- Compression up to 450 bar with 2 bar supply pressure
- Thermal upgradation from 120 to 250 °C
- Industrial scale hydrogen storage and purification systems for 200 kg H_2



Dr. E. Anil Kumar

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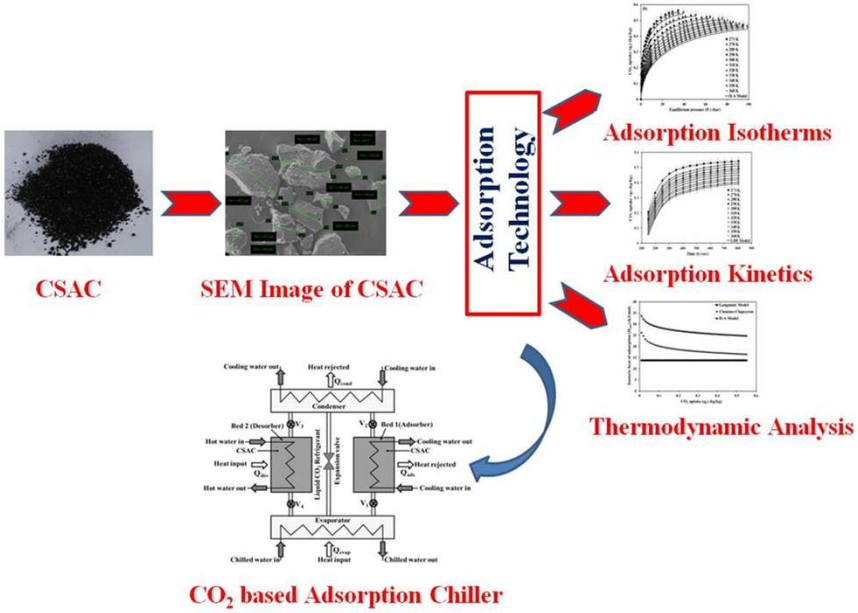
भारतीय प्रौद्योगिकी संस्थान तिरुपति

TIRUPATI

- PhD – IIT Madras
- Areas of Specialization – Hydrogen storage, metal hydrides, energy storage

Areas of Research

- Hydrogen storage – Metal hydrides
- Thermal energy storage
- Sorption heating and cooling systems
- CO_2 capture and sequestration



Development of adsorption chiller using coconut shell based activated carbon.

Vinod Kumar Singh, **E. Anil Kumar**, Bidyut Baran Saha, Adsorption isotherms, kinetics and thermodynamic simulation of CO_2-CSAC pair for cooling application, Energy, 160 (2018) 1158-1173.

Dr. Madan Mohan A

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भारतीय प्रौद्योगिकी संस्थान तिरुपति

TIRUPATI

- PhD – IISc, Bangalore
- Postdoc experience – Brunel University London
- Areas of Specialization – Atomization and Combustion

Areas of Research

- Atomization and combustion of multicomponent fuels and blends
- Atomization of viscous liquids
- Agriculture sprays

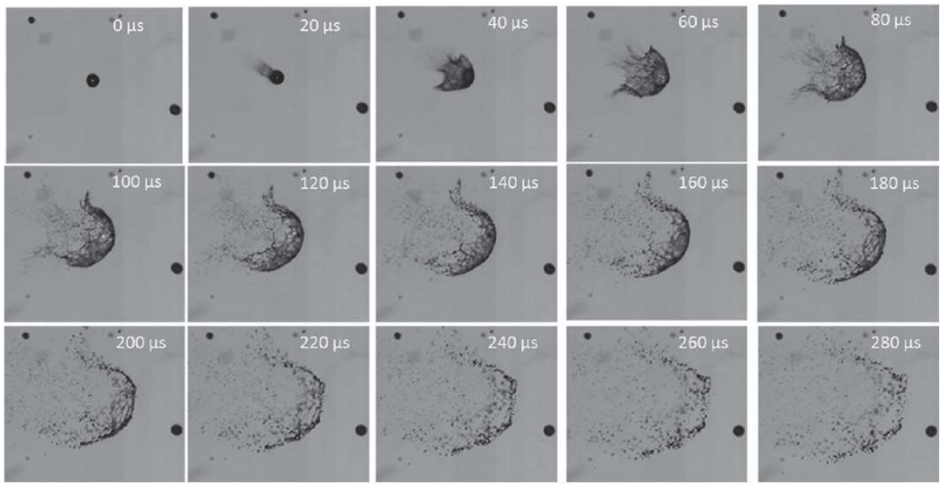

Image sequence showing micro-explosion of secondary droplets resulting from the explosion of suspended droplets. Micro-explosion of droplets start as strong puffing making droplet bag or sheet like structure before it breaks up into smaller droplets

Madan Mohan A, Lionel Ganippa, Jun Xia and Athanasios Megaritis , Puffing and micro-explosion of diesel-biodiesel-ethanol blends, Fuel, 166,59-66, 2016.

Dr. N. Gnanasekaran

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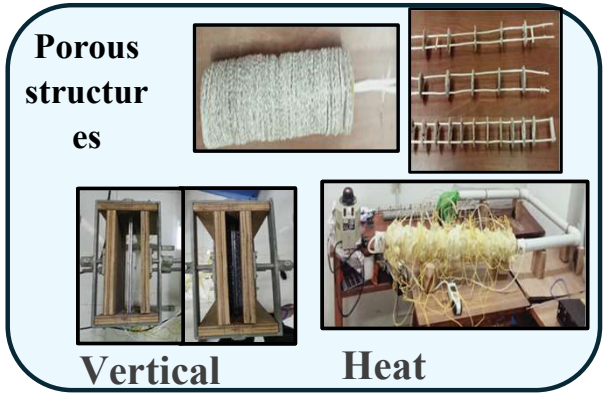
भारतीय प्रौद्योगिकी संस्थान तिरुपति
IIT TIRUPATI

- Ph.D. – IIT Madras, India
- Post-doc – Federal University, Rio de Janeiro, Brazil
- Areas of Specialization – Inverse Heat Transfer, Energy Systems & Porous media

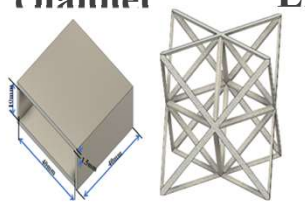
Areas of Research

- Estimation of unknown parameters using inverse techniques
- Fluid flow and heat transfer through porous structures
- Development of compact heat exchangers using additively manufactured lattice structures
- Phase change materials
- Microchannel heat transfer
- Bio-heat transfer

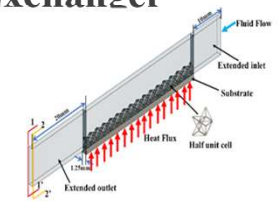


Heat Sink with PCM

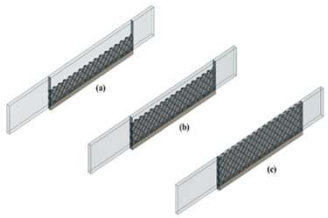
Dynamics of fluids in lattice structure



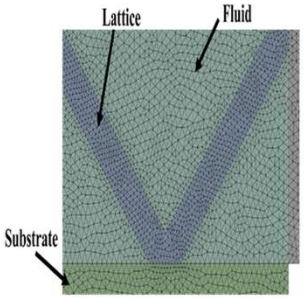
Schematic diagram (a) Heat sink (b) Unit cell of octet structure



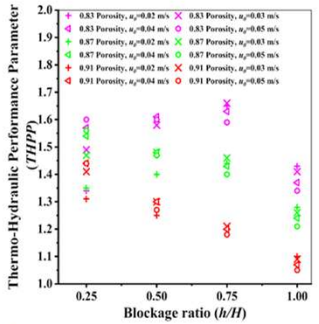
Computational domain for blockage ratio 0.25



Computational domain for blockage ratio (a) h/H = 0.5 (b) h/H = 0.75 (c) h/H = 1

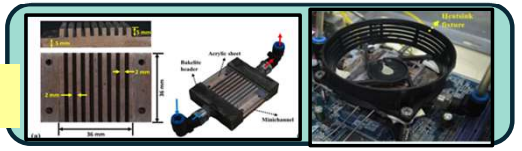


Mesh for the computational domain



Conclusions:

- For higher blockage ratios (1/0.75), pressure drop increases as the porosity of the octet structure decreases, but this effect diminishes for lower blockage ratios (0.5/0.25).
- Based on the thermo-hydraulic performance parameter, the optimal configuration is a heat sink with a blockage ratio of 0.75, a porosity of 0.83, and an inlet velocity of 0.03 m/s.



Microchannel

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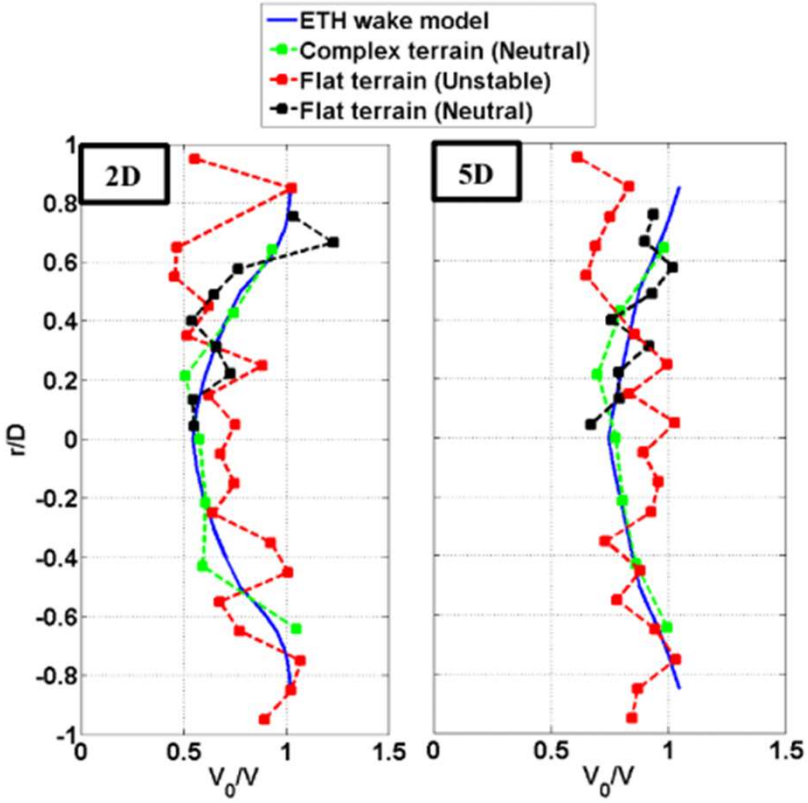
भारतीय प्रौद्योगिकी संस्थान तिरुपति

IIT TIRUPATI

- PhD – ETH Zurich, Switzerland
- Postdoc experience – UC Santa Barbara, CA
- Areas of Specialization – Experimental and computational fluid dynamics, wind energy

Areas of Research

- Demonstrate the effectiveness of drone based wind resource assessment
- Active flow control employed in rotor to improve wind turbine efficiency
- Designing and building a 5 kW low cost horizontal axis wind turbine blade in-house



Comparison between the spatially-averaged spanwise profiles of wind speed measured using drone based wind measurement system under different atmospheric conditions and the predictions from the ETH wake model at two-diameter and five-diameter downstream of a wind turbine.

B.Subramanian, N.Chokani and R.S.Abhari, 2018, "Impact of Atmospheric Stability on Wind Turbine Wake Evolution," *Journal of Wind Engineering and Industrial Aerodynamics*, v.176, p. 74-82.

Dr. Girish Kumar Rajan

Assistant Professor

Department of Mechanical Engineering

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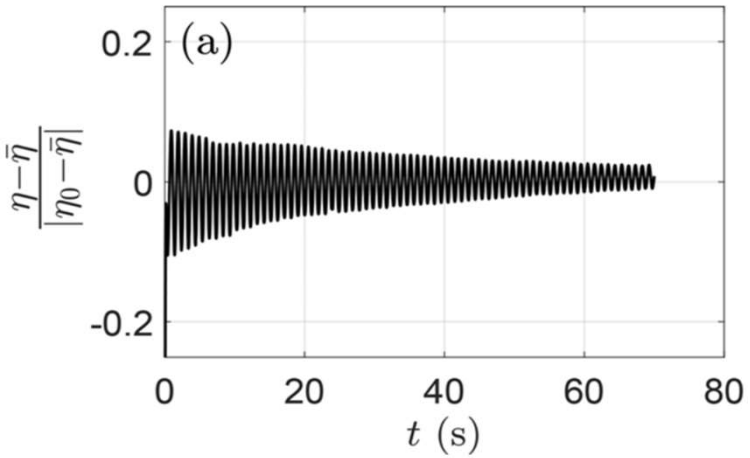
भारतीय प्रौद्योगिकी संस्थान तिरुपति

IIT TIRUPATI

- MA (Mathematics) - Penn State
- MS (Mech. Engr.) - Penn State
- PhD (Mech. Engr.) - Penn State
- Areas of Interest:
  - Fluid Mechanics
  - Wave Hydrodynamics
  - Applied Mathematics

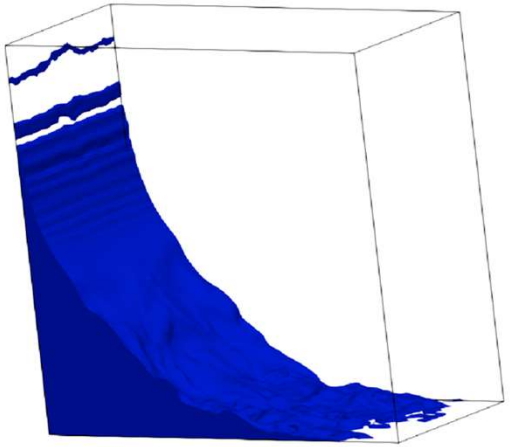


Wave damping in a rectangular tank:
Time series of measured displacement of water surface covered with a thin layer of oil when a 1 Hz standing wave is generated in the tank

Ref: **Rajan, G. K.**, Damping rate measurements and predictions for gravity waves in an air-oil-water system, Physics of Fluids, Vol. 34(2), p. 022113, **2022**.

Areas of Research

- Surface gravity waves
- Interfacial waves in fluids
- Wave dissipation
- Mathematical modeling of fluid flows
- Sloshing Dynamics
- CFD simulation of fluid flows



Sloshing in a rectangular container:
CFD simulation of flow within a rectangular container moving over an uneven terrain. Result shown for a specific time instant.

Dr. Srinivasa Krishna Addepalli

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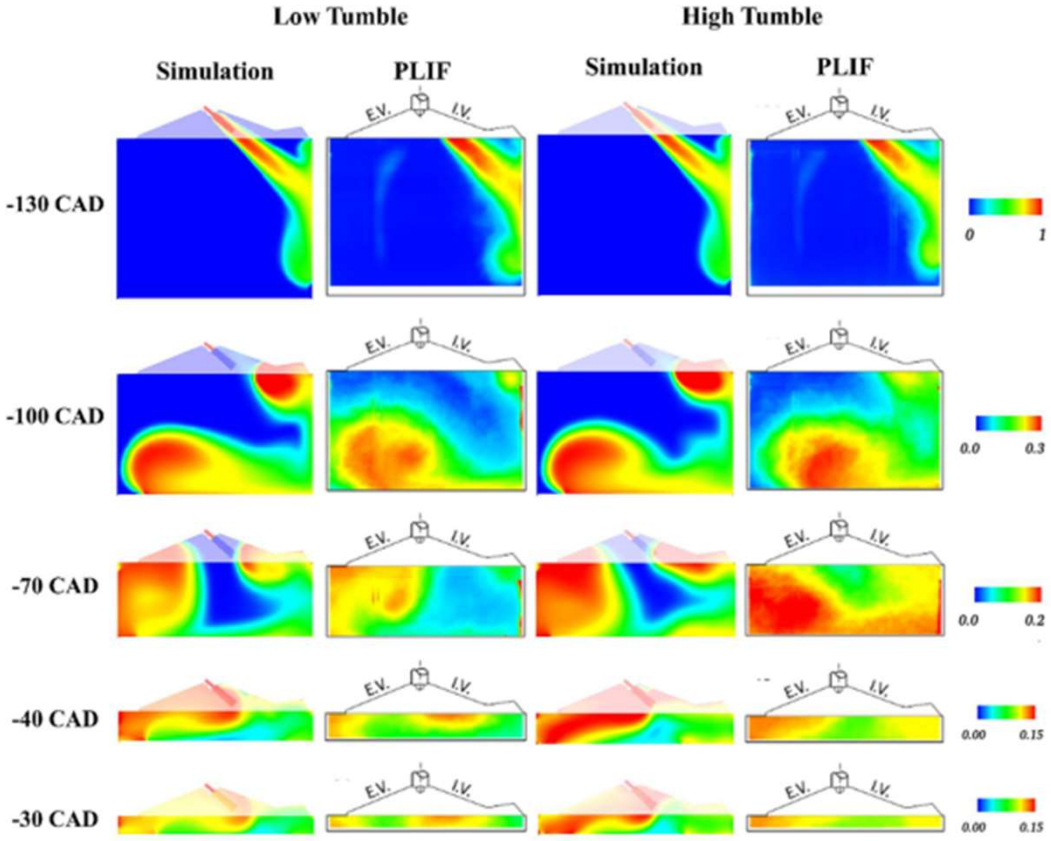
भारतीय प्रौद्योगिकी संस्थान तिरुपति

TIRUPATI

- PhD – IIT Madras
- Post-Doc – Argonne National Laboratory, USA
- Area of Specialization – Energy Systems, CFD, Combustion

Areas of Research

- Carbon-less fuels for transportation
- Machine learning techniques for combustion modeling



S.K. Addepalli, Y Pei, Y Zhang, R Scarcelli, Multi-dimensional modeling of mixture preparation in a direct injection engine fueled with gaseous hydrogen, International Journal of Hydrogen Energy, 2022, Vol. 47 (67), 29085-29101.

Dr. Vignesh T.G.

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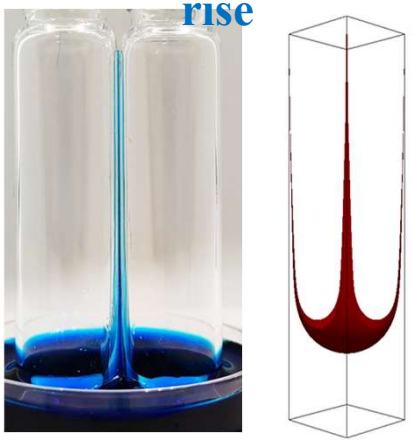
भारतीय प्रौद्योगिकी संस्थान तिरुपति
IIT TIRUPATI

- PhD – Technische Universitat Darmstadt
- Areas of Specialization – Multiphase flows (Particles, Drops, Bubbles & Thin films)

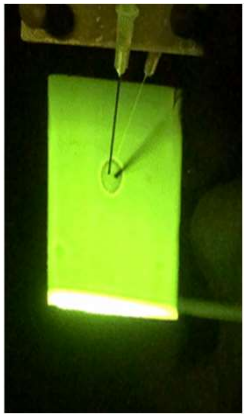
Areas of Research

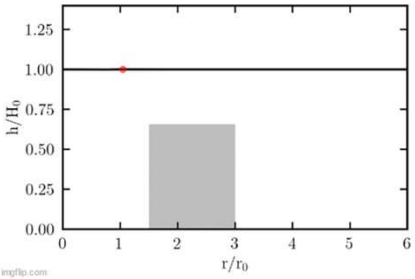
- Corner capillary rise
- Marangoni spreading of drops on thin films
- Inkjet printing dynamics of shear thinning liquid
- Dynamics of compound drops and bubbles

Corner capillary rise

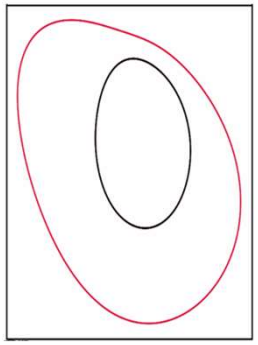


Marangoni spreading on thin films





Compound drop dynamics



Particle impact on free surface

Inkjet printing

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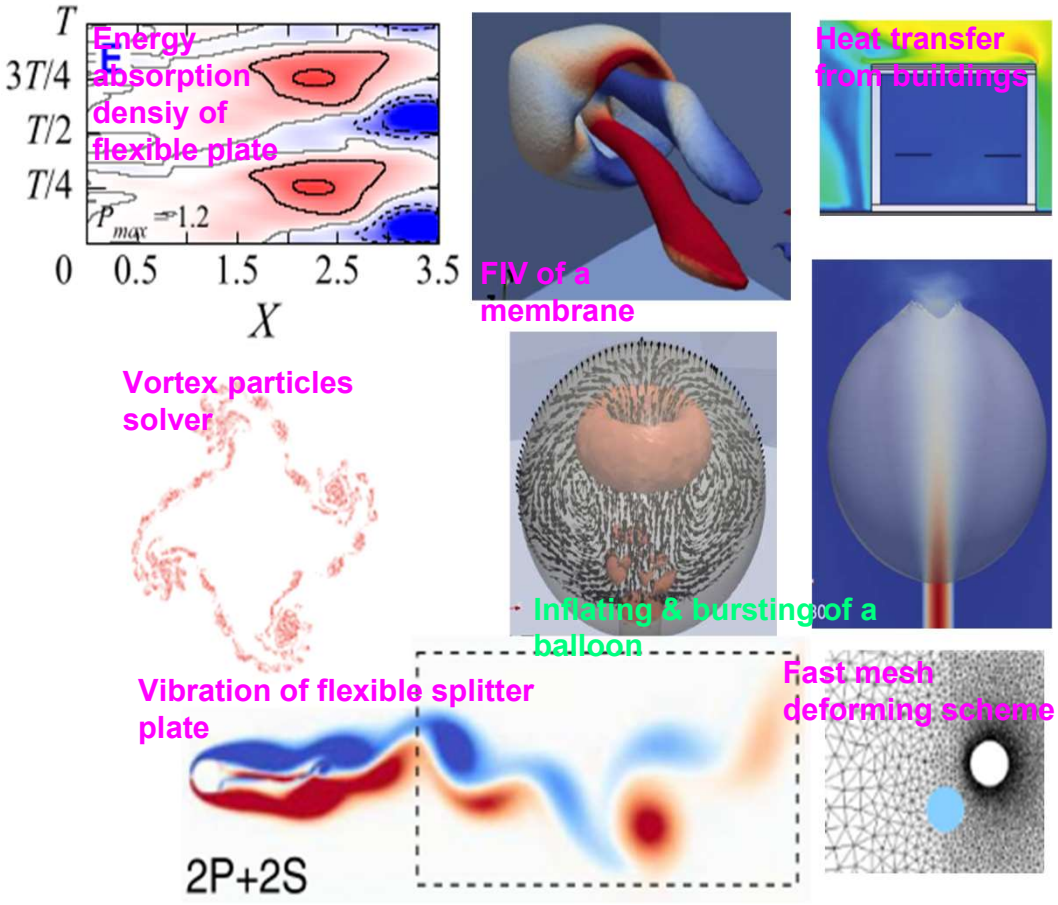
भारतीय प्रौद्योगिकी संस्थान तिरुपति
IIT TIRUPATI

- PhD – IIT Kanpur, India
- Areas of Specialization – Fluid-Structure Interaction, Computational Mechanics

Areas of Research

- Flow-Induced Vibration
- Inflatable Structures
- Finite Element Method/Numerical Algorithms
- Convective Heat Transfer
- Compressible flows
- Meshless Methods
- Energy Harvesting



M. Furquan, S. Mittal, "A finite element framework for fluid–membrane interactions involving fracture"Computer Methods in Applied Mechanics and Engineering, 2023, Volume 417, Journal of Materials Processing Technology, 2019, Volume 266, Pages 116438.