



आईआईटीएम की 56वीं 'प्रो. आर. अनंतकृष्णन' वार्ता IITM's 'Prof. R. Ananthakrishnan' Colloquium (56th)



Late Prof. R. Ananthakrishnan (Ex-Director and Honorary Fellow of IITM, Pune) started his research career as a research scholar in the field of light scattering under the guidance of Nobel Laureate Prof. C.V. Raman and was awarded D.Sc. in 1937 from University of

Madras. Then he joined IMD and occupied several positions up to DDG and then he worked as Director IITM during 1968-1971. He was awarded Padmashree by President of India in 1969 and Nobel Laureate Prof. C.V. Raman Centenary Medal in 1988. He was elected as an INSA Fellow in 1961 and was also member of many learned and professional societies like (Indian Academy of Sciences, Maharashtra Academy of Sciences). He was associated with many technical committees and working groups of WMO Geneva. He was editor of reputed national and international journals in Meteorology.

Prof. R. Ananthakrishnan was deeply associated in organizing and teaching M.Sc./M.Tech. Courses in Meteorology at University of Cochin and University of Pune. Under his able guidance 12 persons were awarded Ph.D.

Research contribution of Prof. R. Ananthakrishnan covers wide range topics *viz.* Light Scattering and Raman Effect, Solar Physics and Meteor Astronomy and Meteorology. In the field of Meteorology he covers: Aerology, Dynamics, Thermodynamics, Monsoon Circulation, Tracks of Storms and Depressions. Atmospheric pressure and oscillations, Indian Rainfall and features associated with onset of southwest monsoon and identification of errors in upper air data. To meet defense needs he organized the publications entitled 'Climatology of Himalayas, Tibet and adjoining areas'. There are 110 national/international (research papers/technical contributions) papers to his credit and a book entitled 'An introduction to Meteorology'. This text book is found to be extremely useful to all the new comers in the field of meteorology. Prof. R. Ananthakrishnan pursued his research and guidance in atmospheric science even after his retirement as an Honorary Fellow of IITM till his last days.



Dr. Vivek Mugundhan

Postdoctoral Fellow, KAUST, Saudi Arabia

Title of the Talk: "High-Speed Volumetric Measurements of Turbulent Flow through a Contraction using Lagrangian Particle Tracking Velocimetry"

Abstract: Most flows that we encounter everyday are unsteady, three-dimensional, and turbulent. Understanding turbulence is important in predicting the performance of engineering devices, and atmospheric flow patterns to name a few. Lagrangian Particle Tracking Velocimetry (LPT) together with high-speed cameras, can provide time-resolved, 3-D velocity field. In this talk, we present the evolution of coherent structures through a smooth, two-dimensional 2.5:1 contraction measured using LPT. The experiments are performed in a water tunnel with an active grid, which generates turbulence at Taylor-Reynolds number, $Re_\lambda \approx 220$ at the contraction inlet. The particle images are acquired using four high-speed cameras and the velocity field is computed using the Shake-The-Box particle tracking algorithm. Coherent structures visualized by isosurfaces of vorticity magnitude showed long tubular vortical structures and structures aligned with the mean flow near the exit of the contraction. The probability density function (PDF) of the orientation of these structures showed a transition from a uniform to a "preferential" distribution as we move through the contraction. The volumetric velocity field also enables us to calculate the simultaneous circulation in three perpendicular planes. Forming a circulation "vector" and studying the PDF of the relative strength of its components reaffirmed this preferential orientation.

References:

- Mugundhan, V., Pugazenthi, R. S., Speirs, N. B., Samtaney, R. & Thoroddsen, S. T. 2020 "The alignment of vortical structures in turbulent flow through a contraction", *Journal of Fluid Mechanics* 884, A5.
- Mugundhan, V. & Thoroddsen, S. T. 2023 "Circulation in turbulent flow through a contraction", *Journal of Turbulence* 24 (11-12), 577-612.
- Alhareth, A., Mugundhan, V., Langley, K. & Thoroddsen, S. T., "Coherent turbulent structures in a rapid contraction", arXiv:2401.05869.

<https://youtube.com/live/j4JHINf0IQ8?feature=share>

Date: 21st March 2024, 1600 hrs.
Venue: Varahamihira Hall, IITM