



Government of India
Ministry of Human Resource
Development

TURBULENCE IN ENVIRONMENTAL FLOWS

October 29, 2017 to November 4, 2017

Department of Applied Mechanics
Indian Institute of Technology, Delhi– 110016

The host department

The Department of Applied Mechanics at IIT Delhi is primarily engaged in research on fundamental problems of mechanics in the broad areas of solid mechanics, fluid mechanics and materials science. Over the years, the department has been recognized for its expertise in the areas of nonlinear elasticity, composites, impact mechanics, computational mechanics, hydrodynamic stability theory, slurry transport, CFD, turbulence modeling etc. It has recently delved into the areas of bio and nano-mechanics.

Background and Motivation

The rapid pace of development, across the world, over the last 100 to 150 years has had a tremendous impact on the environment. The damage is now painfully evident and includes global warming; climate change; extensive pollution of the air, ground & surface water and the soil; loss of biodiversity, etc. In cities like New Delhi the quality of air has degraded to alarming levels. Any attempt to predict/characterize the extent of the problems and develop possible means to ameliorate them would require a deep understanding of environmental flows. Unlike laboratory flows (or even industrial flows), environmental flows exhibit a very large variation in scale (from a few mm to several hundred km). They also involve the interaction of multiple physical processes; pressure gradients coupled with Coriolis forces due to the Earth's rotation and thermal stratification form the minimum set. More broadly, biological and chemical processes couple with the flow physics to determine environmental phenomena.

It would be possible to address only a part of these complex processes in a one-credit course. Accordingly, the course contents would include:

Stratification and rotation in the environment. Governing equations and non-dimensional parameters. Internal gravity waves. Shear instability. Gravitational instability. Turbulent flow: equations and approaches to modelling. Stratified shear layer turbulence. Breaking of internal gravity waves. The atmospheric boundary layer: convective and stable regimes.

Objectives

- To help participants understand the role of density stratification in environmental flows.
- To enable them to acquire the knowledge of turbulent flow processes that affect air and water quality.

Course Content

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| <i>Introduction to stratification and rotation</i> | <i>Internal gravity waves</i> |
| <i>Stratified shear layer turbulence 1</i> | <i>Stratified shear layer turbulence 2</i> |
| <i>Turbulence from internal gravity waves</i> | <i>Atmospheric boundary layer turbulence 1</i> |
| <i>Atmospheric boundary layer turbulence 2</i> | |

Fees

Participants from:

Academic Institutions: Rs 10000.00

Industry/R&D org.: Rs 15000.00

Students: Rs 5000.00

(This includes charges towards tuition fees, cost of study material and reference materials, examination fees, refreshments during lectures etc.)

Eligibility

- Faculty members of engineering institutions, and researchers from industry and government organizations including R&D laboratories.
- Student students at all levels (senior B Tech/M Sc./M Tech./Ph.D).

Accommodation

This is a non-residential program. The participants are expected to make their own arrangements for stay. Subject to availability, the organizers will try to book accommodation, on payment basis, in the Guest Houses of IIT Delhi, if requested sufficiently in advance.

Faculty

Professor S Sarkar

Blasker Professor of Engineering
Department of Mechanical and Aerospace Engineering
Univ. of California, San Diego

Professor Sarkar is a world-renowned expert on turbulence and environmental flows. He has made seminal contributions in turbulent dispersion, modelling of incompressible and compressible turbulence, large eddy and direct numerical simulations of turbulent flows, stratified turbulence, non-linear internal gravity waves, and tidal flows over topography. He is currently the editor/associate editor of the Journal of Fluid Mechanics (2015-present), Journal of Turbulence (2013-present) and Theoretical and Computational Fluid Dynamics (2006-present).

Professor S V Veeravalli (Department of Applied Mechanics IIT Delhi)

Professor Veeravalli's research interests encompass fundamental problems related to turbulent flows, including stability theory; wind turbines; industrial aerodynamics and design method. He is currently an associate editor of Sadhana and editor, ISME Journal of Thermofluids.

Contact Details

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