

Fluid Vortices : From Vorticity to Differential Geometry

Overview

The ubiquity of fluid vortices in both nature and technology is well known. Ranging from large scale flows in atmospheric science, astrophysical fluid dynamics to microscale mixing of flows in lab on a chip, understanding fluid vortices play a vital role. Since the spatio-temporal evolution of vortices is both complex and non-linear, it is pertinent to develop Mathematical tools that can enhance our understanding. To this end, characterizing and describing the fluid flow features through the geometric aspects of fluid topology enables engineers with vital tools to handle fluid vortices with ease. Such tools would also simplify our analysis of coherent structures in turbulent flows as well. The presence of nodes, saddle points, foci, etc, which are typically observed in surface flow visualizations can be easily explained through the critical point theory. The primary objectives of the course are to develop a primary understanding of the inherent structure present in a complex flow field with vortices. Furthermore, the intriguing phenomena of vortex dynamics will be presented through the available tools of fluid topology and differential geometry.

Dates for the Course	1st August to 6th August 2016
Host Institute	IIT Madras, CHENNAI
No. of Credits	1
Maximum No. of Participants	40
You Should Attend If...	<ul style="list-style-type: none"> ▪ You are an Engineer working on Applied Fluid Dynamics problems ▪ You are Research Scholar working on Fluid Mechanics related problems ▪ You are an Atmospheric Scientist working on weather maps ▪ You are a Scientist/Mathematician/ Engineer working on Fluids
Course Registration Fees	<p>The participation fees for taking the course is as follows:</p> <p>Student Participants: Rs.1000 Faculty Participants: Rs.5000 Government Research Organization Participants: Rs.6000 Industry Participants: Rs.8000</p> <p>The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges.</p> <p>Mode of payment: Demand draft in favour of "Registrar, IIT Madras" payable at Chennai</p>
Accommodation	<p>The participants may be provided with hostel accommodation, depending on the availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel</p>

Course Faculty



Prof. Andrew Gilbert is an applied mathematician, and Professor of Mathematical Physics at the University of Exeter, UK. He specializes in the field of fluid mechanics, magnetic field generation (dynamo theory), vortex dynamics and mixing processes in fluid flows. His interests include the role of symmetry and tools from differential geometry. He has also worked on some problems of Moffatt or eddies in Stokes flows and on the dynamics of magnetically driven 'swimmers' in this regime. He published a book on dynamo theory (with Steve Childress, New York University), publishes in archival journals such as Journal of Fluid Mechanics, and was until recently an editor of Fluid Dynamics Research.



Prasad Patnaik BSV is currently Professor in the Department of Applied Mechanics at IIT Madras, Chennai. He specializes in the development of CFD tools for fluid-structure interaction in a variety of problems ranging from vortex induced vibrations to filament FSI in microflows. His current interests are in Flow control, FSI application in mesh based and meshfree methods.



Prof A J Shaiju is currently Associate Professor in the Department of Mathematics at IIT Madras, Chennai. He has made seminal contributions to the field of control systems theory. After obtaining his Ph.D. from IISc- Indian Institute of Science, he worked at TIFR, University of Nice Sophia Antipolis, and University of New South Wales. His research interests are in the field of Systems & Control Theory, Game Theory, PDE control etc.

Course Coordinator

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URL:
<https://apm.iitm.ac.in/fmlab/bsvp/index.html>