

Instability Methods in Hydrodynamics

Course Code : [171003K10].....

Overview

Fluid flows are often characterized by their receptivity and stability. Their receptivity refers to the response to external forcing, while their stability refers to the behavior of perturbations to the flow: if all perturbations decay in time then the flow is stable. If at least one perturbation grows in time then the flow is unstable. Stability theory can be applied to internal or external flows and across all scales.

The course consists of four units: it begins with an introduction of instabilities that occur in different fluid systems (2 lectures); it then introduces the local stability analysis and its usefulness as a diagnostic tool in simple geometries(5 lectures+ 1 MATLAB tutorial); it explains the need for non- modal analysis(5 lectures+ 1 MATLAB tutorial); the last part describes how the adjoint methods technique is extended to stability analysis (3 lectures+ 1 MATLAB tutorial).

The course is intended to provide the participants with an overview of both general and specific topics on stability problems and receptivity problems within the area of theoretical and numerical methods for instabilities in Hydrodynamics. This will be done by explaining the methodology behind local stability analysis, global stability analysis and adjoint methods. It will introduce concepts based on spatial analysis, Gaster's transformation, spatio-temporal stability analysis, re-constructing a global mode from a local analysis, and applying this to industrial flows. Several techniques based on optimization and system-theoretic approach will be introduced for the analysis of fluid behavior for a class of fluid flows.

Modules	December 18 – 22, 2017: The last date of enrolment is November 15, 2017 Introduction to Hydrodynamic Stability, Modal stability analysis, Non-modal stability analysis, Adjoint methods in stability analysis Number of participants for the course will be limited to fifty.
You Should Attend If...	Students (B.Tech, M.Tech, MS, M.Sc, PhD) or faculty from reputed Institutions, engineers and scientists and researchers from R&D laboratories, people from industry who are interested in modeling and control of fluid flow.
Fees	<p>The participation fees for taking the course is as follows: Student Participants: Rs.2000; Faculty Participants: Rs.6000; Government Research Organization Participants : Rs.10000; Industry Participants: Rs.20000 The above fees is towards participation in the course, the course material, computer use for tutorials and assignments.</p> <p>STEP – 1: One-time web-registration at GIAN portal (http://www.gian.iitkgp.ac.in/GREGN/index) through a non-refundable payment of Rs. 500/- (one-time). [A copy of enrolment form to be sent to course coordinator].</p> <p>STEP – 2: Course Registration The shortlisted candidates will be informed by email. They need to make full payment of the course registration fee.</p>

Accommodation	<p>Modes of payment:</p> <p><u>Online transfer:</u> Account Name: CCE IIT Madras Acc. No.: 3640111110 IFSC Code: SBIN0001055</p> <p>Branch: SBI, IIT Madras Branch, Chennai SWIFT Code: SBININBB453</p> <p>OR</p> <p>Demand draft in favour of "Registrar, IIT Madras" payable at Chennai. The demand draft is to be sent to the Course Coordinator at the address given below. Email the copy of demand draft and registration form to the course coordinator.</p> <p>The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link: http://hosteldine.iitm.ac.in/iitmhostel/ For any query, please email at: ushar@iitm.ac.in</p>

The Faculty



Prof. Matthew Juniper is now Professor of Thermofluid Mechanics at the Engineering Department of Cambridge University. His research interests are in the broad area of hydrodynamic and thermoacoustic instability, particularly nonlinear behavior in thermoacoustics, adjoint-based sensitivity analysis, shape optimization and automated learning. He is the leader of the UK Fluids Network (www.ukfluids.net) and is Associate Editor of the International Journal of Spray and Combustion Dynamics. As the leader of the Indo-UK Advanced Instability Methods Network, he organized 15 workshops on various aspects of flow instability and has given invited tutorials on flow instability at Nordita and the Von Karman Institute.



Prof. R. Usha is now a Professor of Mathematics at the Department of Mathematics, Indian Institute of Technology Madras. Her research interests are in the area of wave dynamics and Hydrodynamic instability of interfacial flows and flows in confined geometries.

Course Co-ordinator

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