



Hydrodynamic Stability: Theory, Computation and Applications

Indian Institute of Technology Ropar, December 11-15, 2017

Overview

Hydrodynamic stability plays a very important role in many industrial and environmental processes as well as in transition to turbulence which has bearing for many practical fields, such as enhanced oil recovery, CO₂ sequestration, spreading of contaminant, chemical separation to name a few. This subject at a very basic level is about the effect of infinitesimal disturbances on an otherwise well behaved smooth event or equivalently smooth flow. Whether the effect of such disturbances is going to grow or decay depends on the various parameters of the associated problem including initial data. At times large effects of small disturbance may be desirable such as in mixing between fluid phases and various species in order to enhance chemical reaction. There are situations when it may not be desirable such as in secondary oil recovery where fingering instability is known to be detrimental to oil recovery. Thus there is a need for controlling the growth of instabilities depending on the overall objective of an industrial process whose performance depends on the dynamics of these instabilities. This course will introduce systematically the theory of hydrodynamic stability, which will allow quantification of these growth rates for various flows. These mathematical results can then be used to select appropriate system level controls for improving performance of the system. The course lectures will be designed with a broad audience from mathematics, physics and engineering disciplines in mind. The examples presented and exercises for the course participants will be tailored to complement the theory taught. Computational tools will be used to exemplify many aspects of this subject.

Objective

The primary objectives of the course are as follows.

- (i) Exemplifying in-depth the significance of hydrodynamic stability; with basic mathematical underpinning such as bifurcation theory, eigenvalue problems and normal mode analysis.
- (ii) Formulating many practical problems of industrial and environmental interests within appropriate mathematical frameworks for suitable mathematical analysis.
- (iii) Providing insights as well as mathematical formulas in some cases for harnessing the results of the lectures to improve system level performance such as enhancing oil recovery.
- (iv) Exemplifying many faces of turbulence and transition to turbulence.

Duration & Venue	December 11 – 15, 2017, Indian Institute of Technology Ropar
Modules	Introduction, Instability in incompressible potential flows, Miscible and immiscible porous media flows, Thermal instability, Transition to turbulence, Applications Number of participants for the course will be limited to fifty.
You Can Attend If...	<ul style="list-style-type: none">• Students at all levels (BTech/MSc/MTech/PhD) or Faculty from reputed academic institutions• Engineers and researchers from R&D laboratories.

Fees	<p>The participation fees for taking the course is as follows:</p> <p>Student Participants: Rs.2000 Faculty Participants: Rs.6000 Government Research Organization Participants : Rs.10000 Industry Participants: Rs.20000</p> <p>The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis and the detail will be informed by e-mail to the shortlisted candidates.</p>
Mode of Registration	<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]. The last date of enrolment is November 10, 2017</p> <p>STEP – 2: Course Registration</p> <p>The shortlisted candidates will be informed by email. They need to make full payment of the course registration fee.</p> <ul style="list-style-type: none"> • either by NEFT (Account holder name: The Registrar, IIT Ropar; Account no: 30836125653; IFSC Code: SBIN0013181; Bank: SBI; Branch Name: IIT Ropar) • or by sending a demand draft in favour of “Registrar, IIT Ropar” payable at Rupnagar-140001, Punjab before the last date of registration. <i>Email the copy of demand draft and registration form to the course coordinator.</i> <p><i>For any query, please email at: manoranjan@iitrpr.ac.in</i></p>

The Faculty



Prof. Prabir Daripa is in the faculty of Texas A& M University, College Station, Texas, USA. He received his B.Tech. in Mechanical Engineering at IIT Kharagpur in 1978 and subsequently got his graduate education at Brown University, USA and received his M.S. in Engineering in 1982, M.S. in Applied Mathematics in 1983 and Ph.D. in Fluid Mechanics in 1985. He held a post-doctoral position at Courant Institute in New York University. He joined the Mathematics Department at Texas A&M University in 1987. He is a member of editorial boards of nineteen journals including Advances in Mathematical Physics and International Journal of Mathematics and Mathematical Sciences. His primary areas of current research are Fluid Mechanics and Computational Mathematics. He has over 110 journal publications and given well over 160 talks in many countries of which over 85 are invited and plenary talks.



Dr. Manoranjan Mishra is an Associate Professor of Indian Institute of Technology, Ropar. He has obtained his doctoral degree from Indian Institute of Science (IISc), Bangalore in 2004. He has been a recipient of Humboldt fellowship of Alexander von Humboldt Foundation, Germany and FRS-FNRS fellowship from Fonds de la Recherche Scientifique, Belgium. He was a postdoctoral fellow at INLN, University of Nice Sophia Antipolis, France. He received the JSPS invitation fellowship in 2015. He has over 35 journal publications and over 50 conference presentations. His primary research interest is in Fluid mechanics.

Course Co-ordinator

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