Computational Modelling of Turbulent Flow and Scalar Transport

Course code: 171021G01

Overview

Turbulence is ubiquitous in nature, and most industrial flows are predominantly turbulent. However, the analysis of turbulent mass, momentum and scalar transport remains one of the most challenging areas of thermo-fluid mechanics due to the wide range of length and time scales encountered in typical turbulent flows. This scale separation is a strong function of turbulent Reynolds number, and the complex interactions that occur due to non-linearity of governing Navier-Stokes equations. A complete physical understanding of turbulent flows necessitates the resolution of a rich variety of multi-physics phenomena. To date, none of the existing experimental and analytical methods is able to cover the full range of scales and associated phenomena occurring in the turbulent flows.

The proposed course will discuss the current state-of-art of turbulence modelling in the context of both RANS and LES, and the fundamental physical principles which underpin these model developments. It will also be demonstrated in this course how the fundamental understanding obtained from DNS feeds into the development of high-fidelity RANS and LES turbulence models. It is important to recognize that this area is extremely dynamic, and continuously evolving with time. This is not meant to be a CFD course, but it focuses on the science of turbulence modelling, which is necessary for computational simulations of turbulent mass, momentum and scalar transport in engineering applications. The topics, which will be covered in the proposed course, will not only provide an exposure to the conventional methods of turbulence modelling but also to some of the newly developed methodologies which have started to yield promising results.

Lectures in this course will be prepared based on the materials from a range of different courses which ran successfully in the past under the guidance of the course instructor in the University of Cambridge, University of Liverpool and Newcastle University. The proposed course will draw heavily on the course instructor's own research papers, and the book chapters authored by him.The course is planned to have a duration of 5 days comprising 10 hours of lectures and 6 hours of tutorial including assignment and discussion.

Modules	The course will cover: Appreciation of the scientific principles governing turbulent flows, Identification of the physical processes which are responsible for the interaction between fluid turbulence and scalar (e.g. heat and species) transport, Awareness of the existing modelling methodologies and their strengths, limitations and applicabilities, Informed choice of simulation techniques, and turbulence models for a particular engineering problem
You Should Attend If…	▪ you are a researchers from government/private organizations/industry including R&D sector ▪ you are a faculty from from reputed academic institutions and technical institutions ▪ you are a student (B. Tech. / M. Sc./ M. Tech. / Ph D)

Fees	The participation fees for taking the course is as follows: **Participants from abroad** **US $200** **Indian Participants** **Industry/ Research Organizations** **INR 5,000** **Research Scientists/ Faculty** **INR 3,000** **Students** **INR 1,000/-** *(Bonafide Letter is required from the Head of the Department/Institute)* The above fee include all instructional materials, computer use for tutorials & and assignments, accommodation and meals. **Number of participants for the course will be limited to thirty.**
Time frame of the course & Venue	**August 10th – 14th , 2020** National Institute of Technology Durgapur Mahatma Gandhi Avenue, Durgapur, West Bengal, India https://www.nitdgp.ac.in

Faculty

Prof. Nilanjan Chakraborty is currently a Professor of Fluid Dynamics at the School of Mechanical and Systems Engineering of Newcastle University. Previously he was a senior lecturer at the School of Engineering of the University of Liverpool. He joined University of Liverpool as a lecturer in 2005 and was promoted to a senior lectureship in 2008. He moved to his current position in 2011 where he heads the Fluid Dynamics and Thermal Systems research group. His research interests include Direct Numerical Simulation (DNS) of turbulent combustion, turbulence and combustion modelling, Reynolds Averaged Navier Stokes (RANS) and Large Eddy Sim-ulations (LES), turbulent convection, natural convection of non-Newtonian fluids, Melt-ing/solidification related heat transfer problems in classical manufacturing (e.g. Casting, Welding) and laser aided manufacturing applications (e.g. Laser Surface Alloying).

Course Coordinator

Dr. Rabindra Nath Barman is Assistant Professor in the Mechanical Engineering Department, NIT Durgapur. He received his B, Tech., M. Tech and Ph. D. from Jadavpur University. He has over 12 year's research experience in the water resources & hydraulic Engineering. He has published more than 40 papers in reputed journals and serving as a reviewer on several reputed journals. He is the principal co-author of the two Springer monographs. He is also a project investigator of research projects granted by DST, IEI and AICTE. His research are includes transport phenomena, fluid flow and heat transfer applications.

Course Co-Coordinator

Dr. Partha Sarathee Bhowmik is Associate Professor in the Electrical Engineering Department, NIT Durgapur. He received his Ph. D. from Jadavpur University. He is also a project investigator of research projects from DST and MHRD. His research interest includes Signal Processing, Soft Computing, and Power Systems stability, FACTS Devices, Smart Grid/Micro Grid, Renewable Energy and Instrumentation.

Registration Procedure

Please follow the following steps for registration:

- Go to GIAN website (https://gian.iitkgp.ac.in/). First time users need to register and pay a one-time fee of ₹500.
- Enrol the course **Computational modelling of turbulent flow and scalar transport (Course code: 171021G01)**. Once the enrolment process is completed an Enrolment Number will be generated.
- Send an email to Course coordinator (rn.barman@me.nitdgp.ac.in) expressing your interest quoting the Enrolment number and wait for acceptance.
- If accepted, pay the relevant course fee online and send the details to the course

Course Coordinator

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&

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Registration Form

Computational Modelling of Turbulent Flow and Scalar Transport

(Course code:171021G01)

Affix your recent passport size colour photograph

1. GIAN Registration/Application Number: _____

2. Full Name: _____

3. Date of Birth:_____

4. Participation type (Industry/Academic/Student):_____
(For registration as Student, please enclose certificate from parent institution)

5. Qualification/Degree Programme: _____

6. Organization: _____

7. Address: _____

8. E-mail ID: _____ **Mobile No.:** _____

9. Fee Detail: Payable to
Beneficiary name: CEP NIT Durgapur
Account Number: 37850318679
Bank name & address: State Bank of India, R E College Durgapur Branch, Bardhaman, West Bengal
IFSC Code: SBIN0002108

i) Transaction No. (e-transfer/RTGS/NEFT):_____Date:_____ Amount:_____
ii) Demand Draft No. (If paid by Demand Draft): _____Date:_____ Amount:_____

10. Accommodation Required: Yes/No: _____in Hostel/Guest House _____

Place :_____
Date : _____ **Signature of the Applicant:** _____