GIAN Course on **Modeling and Simulation of Turbulence**

April 29 – May 3, 2022

Organized by
Department of Mechanical Engineering
and
Department of Mathematics
B.M.S. College of Engineering, Bengaluru

International Faculty
Prof. Andy Chan
Vice-Provost (Research and Knowledge Exchange)
Professor of Fluid Mechanics
University of Nottingham Malaysia

Host Faculty
Dr G Saravanakumar
Dr Gayathri M S

OVERVIEW

Despite its great importance and the tremendous efforts that have been made to understand it, turbulence remains a tough problem. Though great strides have been made and a plethora of predictive turbulence models have been developed, there is only a modicum of guidance available on what is practical and what can be relied upon for design and analysis. Most flows of engineering interest are turbulent. Turbulent flows are characterized by unsteadiness, three-dimensionality, and highly convoluted flow structures that span a wide range of length and time scales. Although features of a turbulent flow can be immensely complicated at any instant of time, their ensemble-averaged mean might not be.

Special and important topic in the fluid mechanics and thermal sciences is the investigation of turbulent fluid flows. This topic is influential in understanding transport in highly disordered flows and other advanced engineering applications, e.g., turbulent mixing and combustion. The course extends the understandings of fluid mechanics to chaotic flows in nature. This course introduces the nature of turbulence and basic equations of turbulent flows. It also emphasizes on the modeling procedures and closures for turbulent flows. It rightly blends theory of turbulence with the advanced modeling aspects of it. Few lectures are also devoted to the measurements aspects in turbulence, very useful for research scholars and advanced learners.

For most engineering applications, interest is only in the mean flow field. The goal in predicting turbulent flows for design and analysis is to account for the relevant physics by using the simplest and the most economical mathematical model possible. Economics is as important as accuracy because predicting turbulent flows can be highly intensive computationally.

In engineering applications, a prediction must be not only meaningful, but also obtained in a reasonable amount of time, in order to have a chance to impact design.

PRIMARY OBJECTIVES

i) Introducing the fundamentals of turbulence flows.

ii) Exposing the participants, the importance of understanding the turbulence flows.

iii) Demonstrating the modeling and simulation of turbulence models by using simulation software packages.

iv) Providing advanced numerical techniques to the participants that will enable them to solve their respective research problems involving turbulence.

v) Giving the participants hands-on training on simulation of turbulence models.

vi) The case study problems in turbulence related to real world will be discussed to enhance the research ability of the participants.

COURSE OVERVIEW

- Turbulent Flows: Introduction, Definition and Features
- Laminar vs Turbulence Flows: Enhanced Diffusivity, Instability and Nonlinearity
- Basic Theories of Turbulence Modeling for CFD
- Zero, One and Two-Equation Models
- K-epsilon Models, Reynolds-Averaged Navier-Stokes Equations (RANS)
- Large-Eddy Simulation (LES) Techniques
- Direct Numerical Simulation (DNS)
- **This Course is offered in Virtual (Online) Mode**
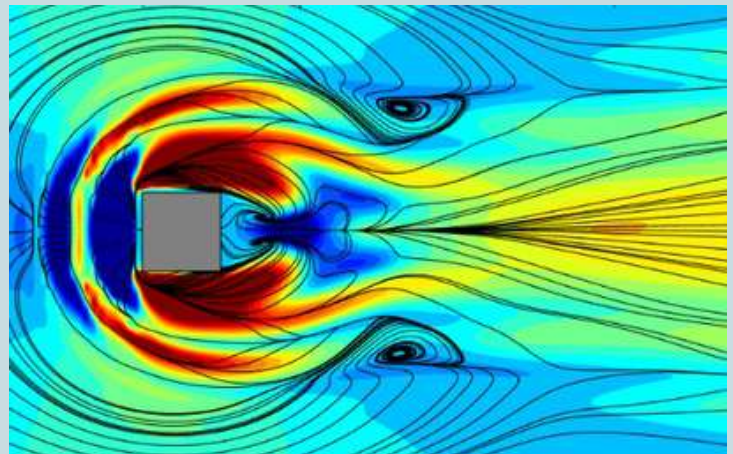
INTERNATIONAL RESOURCE PERSON

Prof. ANDY CHAN is currently Vice-Provost (Research and Knowledge Exchange) and Professor of Fluid Mechanics, Formerly Dean of Faculty of Science and Engineering (2018-2021), University of Nottingham Malaysia. He was awarded the Lord Dearing Award in 2021. He is the Co-chair, Centre of Academic Partnership and Engagement (2016-present); Chair, International Conference on Atmospheric Sciences and Applications to Air Quality (ASAAQ15) (2018-2019); Leader, Go Africa! and Go China! (2018 to present) a recruitment drive connecting the Africa and China with Malaysia; Leader, Dongguan University of Technology Doctoral Training Scheme (DGUT-DTC) (2017-2020); Shantou University (2020); Chair, Review of Processes of Recruitment, Admission and Marketing (PRAM) (2016-2017); Founding Director, Asia Aerospace City Research and Technology Centre (ASIACRAT) (2013-2017); Malaysian Lead, Seven Southeast Asia Studies (7SEAS) (2012-present). He was the Head of research team, World Health Organization (WHO) on the study of SARS virus dispersion in urban areas of Hong Kong (2003).

ABOUT BMSCE

The B.M.S. College of Engineering is the first private Engineering college in India, established by the great visionary and philanthropist, Late Sri. B. M. Sreenivasaiah in the year 1946, located opposite to the historical Bull Temple in Basavanagudi, Bangalore. It is an autonomous institution affiliated to Visvesvaraya Technological University, Belagavi and approved by All India Council for Technical Education, New Delhi. It is the first few institutions in India to be bestowed with NBA in Tier-I Format (Washington Accord) in the year 2013. BMSCE is accredited by National Assessment and Accreditation Council (NAAC) with highest grade of A++ in the second Cycle with a CGPA of 3.83 on a scale of four. Proud recipient of TEQIP-III (World Bank Funded Project) after successful participation in TEQIP-I and II. BMSCE is the only partner institution in the country associated with the Melton Foundation, USA which promotes cross-cultural learning for selected students along with peers from five other countries. It is one of the most preferred higher educational destinations for students from all across the country and also attracts students from South Asian and African countries. BMSCE is in its 75th year of dedicated service in the field of Engineering Education. BMSCE is currently offering fourteen UG, fifteen PG programs and doctoral programs, besides several consultancy and research activities.

For more details, visit : **http://www.bmsce.ac.in/**

REGISTRATION PROCEDURE

Step #1: Web Portal Registration: Visit GIAN website at link: https://gian.iitkgp.ac.in/GREGN/index and create a login user ID, and password. Fill up the GIAN registration form and complete web registration by paying Rs.500/- online through Net Banking/ Debit/ Credit Card as per instructions given there in. This provides the user with the life time registration to enroll in any number of GIAN courses offered. This step is not required, if already registered with GIAN portal.

Step #2: Course Registration: Login to the GIAN portal again with the user ID and password already created in Step #1. Click on course registration option at the top of the registration form. Select the course titled "Modeling and Simulation of Turbulence" from the list and click on the Save option. Confirm your registration by clicking on the Confirm Course option.

Step #3: The participant may then proceed for the course registration with the course coordinator by filling out the online registration form (google form), after making the payment for the course registration through IMPS/NEFT/Demand Draft on or before **April 20, 2022.**

Link for the course registration: https://tinyurl.com/mpw5s42e

Step #4: The scanned image of the payment transaction receipt may be sent to the coordinator at **gurusaravana.mech@bmsce.ac.in**

The maximum number of participants of the program would be limited to 100. Selected participants will be informed by the coordinators.

THIS COURSE IS FOR

Students of B.E./B.Tech./M.Tech./Ph.D. (Civil/Mechanical/Production/Aerospace Engineering), M.Sc. (Mathematics), Faculty from academic and technical institutions, executives, engineers & researchers from government organizations / industries, R&D establishments.

ABOUT GIAN COURSE

Govt. of India approved a programme titled Global Initiative of Academic Networks (GIAN) in Higher Education, aimed at tapping the talent pool of internationally renowned scientists and entrepreneurs. This is to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence.
For more details, visit **http://www.gian.iitkgp.ac.in**

HOST FACULTY/COURSE COORDINATORS

Dr. G SARAVANAKUMAR is a Professor of Mechanical Engineering, B.M.S. College of Engineering, Bengaluru. His research interest is modeling of nanofluid based magnetorheological squeeze film dampers, thermo-fluid rheological behavior. He has executed a couple of sponsored research projects. He is holding a granted patent on "Bump Foil Squeeze Film Dampers with Floating Shims in the Constrained Space" and published a patent on "Flexible Coupling Apparatus". Currently he is guiding a PhD research scholar.

Dr. GAYATHRI M S has over 20 years of teaching and 15 years of research experience. Obtained Ph.D. degree in Applied Mathematics from Bangalore University in the year 2008. She was the recipient of 2 Gold medals during Master's Degree. She is working as Assistant Professor in the Department of Mathematics, B.M.S. College of Engineering from 2007. Her research interests are mainly focused on convective instabilities of time dependent fluid flows in the presence of external fields. Her research field also extended to the implementation of numerical methods like Galerkin Residual method and Spectral Methods for differential equations. She has published 9 articles in leading international journals and proceedings of international conferences. She had presented a paper in the International conference on Plasma Fluids, held at Verenna, Italy in 2005. She has guided two PhD research scholars and currently guiding one.

COURSE REGISTRATION FEE IS AS FOLLOWS

Participants from Abroad	: US $ 50
Industry/Research Organizations	: INR 1000
Faculty Members	: INR 600
Students/Research Scholars	: INR 300

Fee to be paid to:

Account Number	:20274181802
Account Name	:HOD MECHANICAL
IFS Code	:IDIB000B607
Bank/Branch	:Indian Bank/Hanumanthanagar

DATES TO REMEMBER

Registration closes on	:20/04/2022
Course commences on	:29/04/2022

ADDRESS FOR CORRESPONDENCE
Dr. G. Saravanakumar
Associate Professor
Department of Mechanical Engineering
B.M.S. College of Engineering
Bengaluru – 560019. Mob: +91 9886613176
Email: gurusaravana.mech@bmsce.ac.in

Dr. Gayathri M S
Assistant Professor
Department of Mathematics
B.M.S. College of Engineering
Bengaluru – 560019. Mob: +91 9480434908
Email: msgayathri.maths@bmsce.ac.in