Structural Dynamics, Aerodynamics and Vibration Control of Wind Turbines

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Overview

Wind power generation capacity in India has significantly increased in the last few years and till last year the installed capacity of wind power was 27,676.55 MW. Ministry of New and Renewable Energy (MNRE) had set up a committee to reassess the potential through the National Institute of Wind Energy (NIWE, previously C-WET) and has announced a revised estimation of the potential wind resource in India from 49,130 MW to 302,000 MW assessed at 100 m hub height. The wind resource at higher hub heights that are prevailing is possibly even more. Most of the wind power generated in the future will come from next generation wind turbines. With the increased size and flexibility of the tower and blades, structural vibrations are becoming a limiting factor in the design of even larger and more powerful machines. Blades manufactured with composite materials may experience damage and delamination and thus need critical monitoring. Further, limitation on the tip speed of the blade due to noise generation puts a cap on the energy capture from the available wind energy. In addition, vibration control of the offshore wind turbines poses a serious challenge to further development of such machines including foundation and geotechnical aspects. Conventional problems related to power generation systems, like gear box vibrations, electro-mechanical coupling and vibration safety of power electronic converters become more critical for wind turbines where instabilities in the response complicate the situation with blade-tower coupling and aeroelastic effects. These may have an impact on the generation of power and the reliability of the power system with related economic effects.

Objectives

The primary objectives of the course are as follows:

- Exposing participants to the fundamentals of wind turbine mechanics
- Building in confidence and capability amongst the participants in application of the tools and techniques to estimate wind resources, forecast wind power, and carry out site specific design of wind farms,
- Providing exposure to practical problems and solutions, related to structural dynamics and aerodynamics of wind turbines,
- Enhancing the capability of participants to design and apply structural control techniques for power and vibration control.

Hence, to expose the Indian engineers and scientists to these aspects and to train them to serve the Indian industry to be globally competitive, this course focusses on some multidisciplinary scientific aspects of aerodynamics, structural dynamics and vibration control of wind turbines. Course participants will learn these topics through lectures and hands-on numerical experiments. Also case studies and assignments will be shared to stimulate research motivation of participants.

Dates	April 16 – 20, 2019
Place	Department of Mechanical Engineering, National Institute of Technology Silchar, India.
Modules	**Introduction to Wind Turbines** **Wind Energy Fundamentals** **Aerodynamics of Wind Turbines** **Structural Modelling of Wind Turbines** **Offshore Wind Turbines** **Vibration Control of Wind Turbines**
Who can participate	- Interested graduate students, research scientists and industry professionals working in the energy industry. - Some undergraduate students with prior exposure to at least one of the courses on "Aerodynamics", "Structural dynamics", "Vibration" and "Wind Energy". - Researchers in the fields of Structural dynamics, Aerodynamics, Vibration control engineering, and in the disciplines of Mechanical, Electrical, Civil, Aerospace Engineering, or in the areas of Applied Mathematics or Physics. - The teachers/professors who wish to obtain complementary material for their graduate courses in Structural dynamics, Aerodynamics, Vibration Control or Wind Energy Applications to Engineering. - The offshore engineers interested to learn about offshore wind energy for professional application. - Student or faculty from academic institution interested in exposure to recent research developments in the field of structural dynamics, aerodynamics and vibration control of wind turbine systems or subsystems, or want to work with wind energy for non-conventional energy generation. **Participation from outside NIT Silchar will be given preferences.**
Fees	**Participants from abroad: USD 500** **Industry/ Research Organizations: Rs. 10000/-** For Academic Institutions **Faculty: Rs. 5000/-** **External Students: Rs. 1000/-** **Internal PG & PhD Students: Rs. 1000/-** **Internal UG Students: Nil** The above registration fee is towards instructional materials, computer use for tutorials, 24 hours free internet facility, light refreshments etc. The outstation participants will be provided twin sharing accommodation on payment basis in Institute Guest House if available.

The Expert

Prof. Biswajit Basu is currently affiliated to the School of Engineering Trinity College Dublin, Ireland. He earned his doctoral degree in 1998 from the Indian Institute of Technology Kanpur for his work on the time-frequency analysis of non-stationary processes and dynamical systems (Signal Processing). He started his professional career as a Lecturer in the Department of Civil Engineering, Jadavpur University in 1997 before joining the Department of Civil Engineering, Trinity College Dublin (TCD) in 2002. He has been a Visiting Faculty in Technische Universität Darmstadt, Germany in 2002; a Visiting Professor in the Department of Civil and Mechanical Engineering, Rice University, USA in 2006, a Guest Professor in Aalborg University in July - Aug 2011 and a Visiting Fellow at Newton Institute, University of Cambridge, July - Aug 2017. He has also been a Senior Marie Curie Fellow, Plaxis BV, Netherlands during 2012-13. He is an author of about 150 journal papers, 5 book chapters and 120 refereed conference papers, Prof. Basu has been awarded 7 EU FP7 grants, has coordinated two EU-FP7 projects (SYSWIND, NOTES, ICONN), and received a total of about 4 million euro worth research contracts in the last 5 years (2.6 million-PI, 1.4 million-Co-PI). He has also been the recipient of Ireland's Champion of EU Research Award from The President Michael D. Higgins, 2012. He has completed supervision of 25 PhD, 15 Masters student and 9 post-doctoral researchers till date. He has received several prestigious awards. Among some of his recent awards are: Kobori Award for Structural Control (2014), Phil Doak Award from Institute of Sound and Vibration Research, Southampton (2016); High-end Foreign Expert Award from Govt. of China (2015); Ireland's Champion of EU Research Award by President Michael D. Higgins, (2012); Best Paper award at Indian Geotechnical Conference, at Mumbai, India (2010); and, best conference paper award in the 4th International Conference on condition monitoring, Dublin, Ireland (2009).

Course Coordinator

Dr. Sudip Dey is an Assistant Professor in the Dept. of Mechanical Engg, National Institute of Technology Silchar, India. Previously, he was a Post-doctoral fellow at Leibniz-Institutfür Polymerforschung Dresden e. V., Germany and a Post-doctoral Researcher at Swansea University, UK. He received Ph.D. degree from Jadavpur University in 2013. He is actively engaged in academics, teaching, research and industrial projects. His research interests include meta-materials, computational mechanics, multi-scale analysis and modelling. He has written a book entitled "Uncertainty quantification in laminated composites - A meta-model based approach" (CRC Press). He has several research publications in reputed international journals and conferences.

Registration Guidelines (Step-by-Step):

1. First, 'web register' at GIAN 'Courses Registration Portal': http://www.gian.iitkgp.ac.in/GREGN/index by paying requisite fees. If you're already registered, skip this step.

2. Then, log in, click 'Course Registration' tab on the GIAN Portal, and 'check box' to select this course **(#171031G03) "Structural Dynamics, Aerodynamics and Vibration Control of Wind Turbines"** from the list. Click 'save' to register, and 'Confirm Course(s)' to confirm.

3. Now, pay the requisite Course Fee online in favour of the **Director, NIT Silchar, India, Bank Account No: 10521277057, IFSC Code: SBIN0007061, MICR Code: 788002004**. OR You can obtain Demand Draft in favour of **Director NIT Silchar, India**. Keep the payment info (DD details, transaction # & date) handy. You'll need this during the next step. Also, please retain the receipt for on-spot submission.

4. Next, fill out the form given below, sign it. Send the scan copy of the filled in form with scanned copy of course fee transaction slip or Demand Draft to the course coordinator e-mail address (**gian.nits2019@gmail.com**). This is for the Course Coordinator's record. Now, await the Course Coordinator's confirmation.

5. Next, fill out the form here: **https://docs.google.com/forms/d/e/1FAIpQLSdpS2tO-UMwVhBuiXVzuLyfhoVyz-1fEvHaNXpvNwSeXikFsA/viewform,** and click 'submit'. This is for the Course Coordinator's record. Now, await the Course Coordinator's confirmation.

P.S: Registering on the GIAN portal does not guarantee participation in the course. Please do not confuse with web registration with course registration. You might have been 'shortlisted' after paying the 500/-, but your selection is subject to paying the requisite course fee to NIT Silchar. For successful enrolment, make sure you've made both the payments. Number of participants for the course is limited to 50, and the registration will be open till the seats are filled. For queries and clarifications, write to the Course Coordinator at: **gian.nits2019@gmail.com**

GIAN: Global Initiative of Academic Network

Name of the course: Structural Dynamics, Aerodynamics and Vibration Control of Wind Turbines
(Course Code: 171031G03)
Dates: April 16 – 20, 2019
Department of Mechanical Engineering, National Institute of Technology Silchar, India

REGISTRATION FORM

1. **GIAN Portal Application Number:**

2. **Full Name:**

3. **Category (Industry/Academic/Student):**

4. **Organization:**

5. **Address:**

6. **Email ID:**

7. **Mobile Number:**

8. **Highest Academic qualification:**

9. **Payment option and details:**

a. **Demand draft**

Draft No.	Bank	Date	Amount

b. **Online transaction**

Transaction ID/ Reference No.	Bank	Date	Amount

10. **Accommodation Required:** Yes/No (please tick in the applicable field)

Date:

Place: Signature of Applicant