Computational Efficiency Enhancement Techniques in Forward and Inverse Problems

June 19-23, 2018

Department of Electrical Engineering

राष्ट्रीय प्रोद्योगिकी संस्थान दुर्गापुर

National Institute of Technology Durgapur

Durgapur- 713209, W.B., India

An international summer term course -2018 as per MHRD scheme

"Global initiative of Academic Network (GIAN)"

REGISTRATION FORM

Name (Block Letters): .....

M/F: .....

Designation/Professional Title:

.....

Organization:

.....

Address:

.....Tel:

....., Mobile: .....,

E mail: .....

Application ID (Generated during One-time registration at GIAN portal of IIT Kharagpur): .....

Course Fee: Covers only course materials without boarding and lodging.

Fees Details:

Student/Research Scholar*: Rs. 1000/-

***(Letter of recommendation is required from Supervisor/Head of the department/Institute)**

Faculty/scientist of Institute: Rs. 2000/-

Industry/Research Organization: Rs. 4000/-

Participants from abroad: US $200

Accommodation is available in Institute Guest House/Hotels on request basis. Additional charges will be paid for accommodation.

Payment may be made through:

1. Demand Draft: In favour of "**GIAN_CEET**" payable at Durgapur.

DD /Cheque No: .....

Date: ....., Amount: .....

Bank: .....

OR

2. National Electronic Funds Transfer (NEFT) to the account "**GIAN_CEET**" (Account Number : **8569101003108**)

Bank: Canara Bank ,NIT campus, M G Avenue. IFSC Code: CNRB0008569. MICR Code: 713015203.

Date: Signature of Candidate

Signature with Seal of Recommending/ Forwarding Authority

COURSE BROCHURE

GIAN

(GLOBAL INITIATIVE OF ACADEMIC NETWORKS)

COURSE 2018

ON

COMPUTATIONAL EFFICIENCY ENHANCEMENT TECHNIQUES IN FORWARD AND INVERSE PROBLEMS

June 19-23, 2018

COURSE COORDINATOR

DR. PARIMAL ACHARJEE

NATIONAL INSTITUTE OF TECHNOLOGY, DURGAPUR
MAHATMA GANDHI AVENUE, DURGAPUR
WEST BENGAL, INDIA, 713209

ABOUT GIAN:

Overview:

Global Initiative for Academic Network (GIAN) programme approved by Union Cabinet in Higher Education aimed at tapping the talent pool of Scientist and Entrepreneur Internationally 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. In order to (i) gather the best international experience into our systems of education, (ii) enable interaction of students and faculty with the best academic and industry experts from all over the world, (iii) share their experiences and expertise to motivate people to work on Indian problems, there is a need for a Scheme of International Summer and Winter Term.

Objectives:

1. To increase the footfalls of reputed international faculty in the Indian academic institutes.
2. Provide opportunity to our faculty to learn and share knowledge and teaching skills in cutting edge areas.
3. To provide opportunity to our students to seek knowledge and experience from reputed International faculty.
4. To create avenue for possible collaborative research with the international faculty.
5. To increase participation and presence of international students in the academic Institutes.
6. Opportunity for the students of different Institutes/Universities to interact and learn subjects in niche areas through collaborative learning process.

7. Provide opportunity for the technical persons from Indian Industry to improve understandings and update their knowledge in relevant areas.
8. Motivate the best international experts in the world to work on problems related to India.
9. Develop high quality course material in niche areas, both through video and print that can be used by a larger body of students and teachers.
10. To document and develop new pedagogic methods in emerging topics of national and international interest.

ABOUT THE INSTITUTE:

The National Institute of Technology, Durgapur (formerly Regional Engineering College, Durgapur), was established by an Act of Parliament in 1960 as one of the eight such colleges aimed to function as a pace setter for engineering education in the country and to foster national integration. It is a fully-funded premier Technological Institution of the Government of India and is administered by an autonomous Board of Governors. The Institute is a University which awards B.Tech., M.C.A., M.Sc., M.B.A., M.Tech. and Ph.D. degrees to students after their successful completion of the specified courses. The Institute imparts education in the disciplines of Chemical Engineering, Civil Engineering, Computer Science and Engineering, Electrical Engineering, Electronics and Communication Engineering, Mechanical Engineering, Metallurgical and Materials Engineering, Information Technology, Biotechnology, Physics, Chemistry, Mathematics, Environmental science, Materials Science and Management Studies. In addition to the normal intake, a few seats are reserved for Foreign Students who are nominated by the Ministry of External Affairs, Government of India, and the Indian Council for Cultural Relations, Government of India.

ABOUT THE COURSE:

Overview

Sensors, data acquisition, and real time analysis are ubiquitous these days. Wireless communication industry has been in the forefront of making them available for common usage. Other industries including biomedical, automotive, aviation, and energy are employing sensors to improve operational efficiency, reliability, and maintainability in respective sectors. Designing sensors and processing the acquired data, in many instances, involve dealing with forward and inverse problems. The objective of this short course is to familiarize participants with such problems and solution techniques, drawing illustrative examples from multidisciplinary domains.

Given complete descriptions of a deterministic physical system and a measuring sensor, it is possible to uniquely determine the outcome of some measurement. This problem is referred to as a *forward* or a *direct problem*. An *inverse problem*, on the other hand, involves using measured data and information about the sensor to characterize the physical system. Consider, as an example, the problem of estimating the location and properties of a subsurface object – viz., buried explosives, damaged tissue inside human body, hydrocarbon-bearing earth layers – from data acquired by some appropriate sensor. Such inverse problems are often ill-posed, non-unique, and multimodal. A small error in measurement can lead to large error in estimated parameters. Typical measuring sensors employ acoustic, electromechanical, electromagnetic, and magnetic resonance principles. Designing the sensors becomes challenging, especially when they involve multiscale electromechanical features and operate under harsh environmental conditions.

Forward and inverse problems associated with sensor design and data analysis often require solving a set of boundary value problems involving differential and/or integral equations in conjunction with optimization techniques. There are many numerical methods to solve such problems including a few commercial ones. However, applying these methods directly may become computationally intractable, particularly for large scale industrial applications where degrees of freedom may easily run into millions. There has been a significant improvement in the use of high performance computing platforms to mitigate such problem. Equally important are the computation efficiency enhancement techniques. This short course begins with an overview of forward and inverse problems and then describes existing solution methods. Various techniques are presented to enhance computational efficiency. These include wavelet-based approach for hierarchical solution, dimension reduction techniques, and a combination of deterministic and evolutionary methods for optimization. Examples from multidisciplinary science and engineering fields are considered to illustrate the approach.

OBJECTIVES OF THE COURSE:

The primary objectives of the course are as follows:

i) Expose participants to multidisciplinary aspects of sensor design and data analysis,

ii) Provide theoretical understanding of forward and inverse problems and their solutions,

iii) Familiarize participants with efficient techniques to solve large computationally complex problems,

iv) Guide participants in developing algorithms and/or using existing ones to solve problems.

THE FACULTY:

Jaideva C. Goswami is a Chief Scientist at National Oilwell Varco in Houston. He received his Ph.D. in Electrical Engineering from Texas A&M University. He has served in various technical and management positions in the oil and gas industry for over 20 years in Houston, USA. He is also a former Professor of Electronics and Communication Engineering at IIT, Kharagpur and has held academic positions at the University of Illinois, Urbana-Champaign, IIT, Kanpur, and NIT, Surat. He has many research publications and patents. He is a Fellow of IEEE. His technical expertise and interests include multiphysics modeling, inverse problems, signal processing, subsurface sensor design, data analytics, and nuclear magnetic resonance.

Parimal Acharjee is an Associate Professor and Head of the Department of Electrical Engineering at National Institute of Technology, Durgapur, West Bengal, India. He passed B.E.E. from North Bengal University, M.E.E. and Ph. D. from Jadavpur University, India, Post Doc from New Mexico State University (NMSU), New Mexico. He has three years Industrial Experience and 17 years teaching experience. He continued his teaching profession in MCKVIE, Howrah, BPPIMT, Kolkata, NIT Silchar, India. His research interests include computational analysis, soft-computing techniques and its application in power systems.

Rowdra Ghatak is a Professor and Head of the Department of Electronics and Communication Engineering at National Institute of Technology, Durgapur, West Bengal, India. His research interests include microwave and antenna design.

FEES DETAILS:

Student/Research Scholar: Rs. 1000

Faculty/scientist of Institute: Rs. 2000

Industry/Research Organization: Rs. 4000

Participants from abroad: US $200

The above fees do not include accommodation

(Letter is required from the Supervisor/Head of the Department /Institute/Authority)

The above fee includes all instructional materials, computer use for tutorials, free internet facility. Accommodation on twin sharing basis will be arranged on payment of additional fee.

ELIGIBILITY:

- Executives, Scientists, engineers and researchers from Industries, educational Institute and R & D laboratories.
- Students at all levels (B.Tech/M.Sc/M.Tech/PhD) or Faculty from reputed academic institutions and technical institutions.

REACHING NIT DURGAPUR:

The institute is located 160 Kms north-west of Kolkata on the Howrah-Delhi main railway route and overlooking the national highway No. 2 (the great Grand-Trunk Road).

REGISTRATION PROCESS:

Registration for GIAN course is not automatic because of the constraints on maximum number of participants allowed to register for a course. In order to register for one or multiple non-overlapping courses, you have to apply online using the following steps:

1. Create login and password at www.gian.iitkgp.ac.in
2. Login and complete the registration form.
3. Select courses
4. Confirm your application and payment information.
5. Pay Rs. 500 through online payment gateway.

The course coordinator will go through the application and confirm the selection of a participant one month before the starting date of the course. Confirmed candidates will be requested to pay the full fees through online gateway service. The bank details are given below:

Account name: GIAN CEET
Account Number: 8569101003108
Name of bank: CANARA Bank
IFSC Code: CNRB0008569
MICR Code: 713015203
Address: NIT Durgapur, M G Avenue, Durgapur - 713209

Number of participants for the course is limited to fifty.

FOR MORE DETAILS PLEASE CONTACT :

Dr. Parimal acharjee
Email: parimal.acharjee@gmail.com
Ph: +91 9434788064

WEBLINKS :

1) http:// www.nitdgp.ac.in
2) **www.gian.iitkgp.ac.in**

VENUE: NIT Durgapur, West Bengal, India, 713209

http:// www.nitdgp.ac.in