FOS'18

nature is fractional

16th Feb-20th Feb, 2018

15 hrs practical

WORKSHOP ON FRACTIONAL ORDER SYSTEM

10 lectures

Lecture on:

- Introduction to fractional order (FO) system,
- Basics of fractional order calculus,
- Design and development of FO devices,
- FO control and applications,
- FO filters and resonators

Hands on practice :

- Simulation of FO system design,
- Making of FO circuits and systems,
- FO device fabrication,
- To exhibit FO dynamics in Electrochemical system

Speakers:

Mr. S. Das, Scientist H, BARC, India
Dr. S. Sen, IIT Kharagpur India
Dr. B. Bandyopadhyay, IIT Bombay, India
Dr. R. Caponetto, Catania Univ., Italy
Dr. S. Grazzini Catania Univ., Italy
Dr. M. V. Aware, VNIT, Nagpur, India
Dr. F. A. Khandey, Kashmir Univ., India
Dr. M Khanra, NIT, Silchar, India
Mr. A Adhikary, IIT Kharagpur, India
Dr. K. Biswas, IIT Kharagpur, India

Schedule: (Everyday)
9:30am-11:00am: Lecture
11:00am-11:15am: Tea
11:15am-12:45pm: Lecture
12:50pm-2:30pm: Lunch
2:30pm-5:30pm: Practical session

Venue:
Electrical Engineering Department,
IIT Kharagpur, India.

Contacts: Dr. Karabi Biswas: karabi@ee.iitkgp.ernet.in
Mr. Avishek Adhikary: avishek.adhikary@iitkgp.ac.in

nature is fractional

FOS' 18

16th –20th February, 2018
Department of Electrical Engineering, IIT Kharagpur

Workshop on
"Fractional Order System"
10 lectures
15 hours practical session

Bioprocess Instrumentation Lab,
Dept. Electrical Engg., IIT Kharagpur
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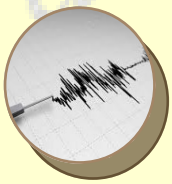
design & writing: Avishek Adhikary

In the past few decades, fractional order (FO) calculus has emerged as a potential tool in various domains of science and engineering. The arbitrariness in the order of the differential equation in FO calculus introduces more degrees of freedoms in design and analysis, resulting in more accurate modelling, better robustness in control and greater flexibility in signal processing. By this time it is established that the electrochemical phenomena like double layer charge distribution or the diffusion process can be better explained with fractional order system. As a result the modelling of lithium ion battery, fuel cells, supercapacitors are carried out with fractional differential equation. The characterization of ceramic bodies, fractal structures, viscoelastic materials, the decay rate of fruits and meats, study of corrosion in metal surface are also promising area of its applications.

FO system is now an emerging topic and a popular choice to study the real time events such as earthquake propagation, volcanic phenomenon, designing of phermo-kinetics, modelling of human lungs and skin. Even the characteristics of economic market fluctuation adopts fractional calculus based system modelling. So in other words, FO analysis has now reached from inert physical network to living networks of biology, ecology, physiology and sociology, reminding us Leibnitz's prediction in his letter to L'Hopital (1695) that the fractional differential operator is ``an apparent paradox from which one day useful consequences will be drawn"



As real systems are better described by FO structure, they are better controlled by FO controllers. Recent researches on FO controllers have shown promising result in this direction. Many researchers are actively engaged to develop fractional order device as this not only offers the possibility of highly useful electronic circuit elements but also allows for the study of complexity in a much broader context.

FOS' 18, an initiative of Bioprocess Instrumentation Lab, Dept. of EE, IITKGP, gives the unique opportunity to come together and share thoughts, to know each other and discuss the findings of the different research groups. The workshop will also facilitate to transfer knowledge to the researches who are new to the domain of fractional order system.

design & writing: Avishek Adhikary

FOS' 18

Chairman: Prof. Siddhartha Sen **Convenor : Prof. Karabi Biswas**

Day 1: 16-02-2018, Friday FN: (9:00 am-12:45pm) Venue: N208 Seminar room, 1st Floor, EE. Dept. IIT Kharagpur
9:00 am: Inauguration of 'FOS'18' workshop
9:30 am -11:00 am: **Lecture 1**: Speaker: **Prof. Munmun Khanra, NIT Silchar, India** Topic: Introduction to fractional order system and realization of multicomponent fractor
11:15 am -12:45 pm: **Lecture 2**: Speaker: **Prof. Karabi Biswas, IIT Kharagpur, India** Topic: Development of single component fractor and its applications.
Lunch Recess: 12:45 pm - 2:30 pm
AN: (2:30 pm-5:30pm) Venue: CCL Lab, 1st Floor, EE. Dept. IIT Kharagpur **Practical session**: Simulation of fractional order immittances

Day 2: 17-02-2018, Saturday FN: (9:30 am-12:45pm) Venue: N208 Seminar room, 1st Floor, EE. Dept. IIT Kharagpur
9:30am -11:00 am: **Lecture 3**: Speaker: **Mr. Avishek Adhikary, RS, IIT Kharagpur, India** Topic: Realization of tunable fractors from any of the four quadrants
11:15 am -12:45 pm: **Lecture 4**: Speaker: **Prof. Siddhartha Sen, IIT Kharagpur, India** Topic: Fractional order filters
Lunch Recess: 12:45 pm - 2:30 pm
AN: (2:30 pm-5:30pm) Venue: BP Lab, N-237, 1st Floor, EE. Dept. IIT Kharagpur **Practical session**: Design and fabrication of single component fractors

Day 3: 18-02-2018, Sunday FN: (9:30 am-12:45pm) Venue: N208 Seminar room, 1st Floor, EE. Dept. IIT Kharagpur
9:30 am -11:00 am: **Lecture 5**: Speaker: **Mr. Shantanu Das, Scientist H, BARC Mumbai** Topic: Importance of fractional calculus in real life engineering & science applications
11:15 am -12:45 pm: **Lecture 6**: Speaker: **Prof. Bijnan Bandopadhaya, IIT Bombay** Topic: Integral sliding mode control for integer and fractional order system
Lunch Recess: 12:45 pm - 2:30 pm
AN: (2:30 pm-5:30pm) Venue: CCL Lab, 1st Floor, EE. Dept. IIT Kharagpur **Practical session**: Practical realization of RC ladder based fractor

Day 4: 19-02-2018, Monday
FN: (9:30 am-12:45pm) Venue: N208 Seminar room, 1st Floor, EE. Dept. IIT Kharagpur

9:30 am -11:00 am: **Lecture 7**: Speaker: **Prof. Riccardo Caponetto, Univ. of Catania, Italy**
Topic: FO PID controllers: stability regions, design and implementation

11:15 am -12:45 pm: **Lecture 8**: Speaker: **Prof. M. V. Aware, VNIT, Nagpur, India**
Topic: Analogue/Digital realization of FO PID for industrial drives

Lunch Recess: 12:45 pm - 2:30 pm

AN: (2:30 pm-5:30pm) Venue: Instrumentation Lab, Gnd Floor, EE. Dept. IIT Kharagpur
Practical session: Practical realization of four quadrant dynamic fractors

Day 5: 20-02-2018, Tuesday
FN: (9:30 am-12:45pm) Venue: N208 Seminar room, 1st Floor, EE. Dept. IIT Kharagpur

9:45 am -11:15 am: **Lecture 9**: Speaker: **Prof. Salvatore Graziani, Univ. of Catania, Italy**
Topic: Nano structured polymeric materials as fractional order elements

11:30 am -12:45 pm: **Lecture 10**: Speaker: **Prof. Farooq A. Khanday, Univ. of Kashmir, India**
Topic: Recent advances in the design and applications of fractional order analog integrated circuits and systems

Lunch Recess: 12:45 pm - 2:30 pm

AN: (2:30 pm-5:30pm) Venue: BP Lab, N 237, 1st Floor, EE. Dept. IIT Kharagpur
Practical session: Application simulations of four quadrant fractors in making FO filters

Registration Details:

Please send the signed copy of filled up registration form, to following mail id:
karabi@ee.iitkgp.ernet.in., **before 6:00 pm, 31st January, 2018**
The subject of mail the should be 'Registration FOS 18_first name_last name'.

List of selected candidates will be published on 1st February, 2018. Account details for fee submission will be sent to the selected candidates only.

Registration Fee:

Industry personnel with accommodation:	Rs. 8000
Professors and other academic personnel with accommodation:	Rs. 5000
Professors and other academic personnel without accommodation:	Rs. 2500
Research scholars with accommodation:	Rs. 2500
Research scholars without accommodation:	Rs. 1000
PG and UG (4th year/ 5th year only) students with accommodation	Rs. 1500
PG and UG (4th year/ 5th year only) students without accommodation	Rs. 500

Accommodation includes lodging only. Working lunch will be provided to all, with or without accommodation. Breakfasts and dinners are not included in accommodation.
Accommodation will be provided from 2:00 pm 15-02-2018 to 11:00 am 21-02-2018.
For any further query, please mail to avishek.adhikary@iitkgp.ac.in.

FOS' 18

Registration Form

1. Name: _____
2. Designation: _____
3. Date of Birth: _____ Gender _____
4. Nationality: _____
5. Permanent Address: _____

   _____

   _____
6. Organization Name: _____
7. Address of Organization: _____

   _____
8. Mail id: _____
9. Contact Number: _____
10. Accommodation Needed? _____
11. Food Type: Veg/Non-veg? _____

_____

(signature of the participant with date)

Please sign the filled up form and send the scanned copy to karabi@ee.iitkgp.ernet.in with subject name: **'**Registration FOS 18_first name_last name**'** before 29th January, 2018. Details on Registration Fee is given in the Brochure. Account details will be sent to the shortlisted candidate only, on 30th January, 2018.