ABOUT GIAN COURSE

MHRD, Govt. of India has launched an innovative program titled "Global Initiative of Academic Networks (GIAN)" in higher Education, in order to garner the best international experience. As part of this, internationally renowned Academicians and Scientists are invited to augment the Country's academic resources, accelerate the pace of quality reforms and elevate India's scientific and technological capacity to global excellence.

A FIVE DAY GIAN COURSE ON

DATA-BASED SYSTEMS AND CONTROL

7TH APRIL- 11TH APRIL 2025
AT IITMANDI

CONTACT US

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Centre for Continuing Education

LOCATION: IIT MANDI NORTH CAMPUS, VPO-KAMAND, MANDI HIMCAHL PRADESH, INDIA PIN-175075

GOOGLE MAP: HTTPS://MAPS.APP.GOO.GL/EQYJHQ9KMVWEDF188

COURSE OVERVIEW

Traditional systems and control theory relies on model-based methods, which assume the availability of a precise mathematical model of the system to be controlled. However, as engineering systems grow increasingly complex, deriving accurate mathematical models becomes challenging. Simultaneously, advancements in technology provide unprecedented access to data, making data-driven approaches a transformative alternative to model-based methods.

This course provides a comprehensive introduction to data-driven control, equipping participants with the tools to analyze and design feedback controllers directly from system data. It delves into cutting-edge developments in the field, focusing on the data informativity framework, which determines the conditions under which collected data are sufficient for solving analysis and control problems effectively.

Through this course, participants will learn how to leverage data for control design without the need for explicit mathematical models. Practical case studies and applications will demonstrate how data-driven techniques are applied to address real-world engineering challenges, such as robotics, autonomous systems, and industrial process control.

The course integrates core concepts from system theory, linear algebra, and mathematical programming, ensuring participants gain both theoretical insights and practical skills. Designed for Master's and Ph.D. students in electrical, control, and computer engineering, as well as researchers and professionals, this course prepares attendees to address the challenges of modern, data-rich engineering systems with innovative solutions.

Course participants will gain knowledge through interactive lectures, hands-on experiments, and software simulations using tools like MATLAB, Python, etc. Case studies and real-world applications will further inspire research motivation, ensuring participants are equipped to address contemporary challenges in data-based systems and control.

WHO CAN PARTICIPATE?

- A Control Systems Engineer or Research Scientist looking to explore modern, data-driven techniques for analyzing and designing control systems without relying on precise mathematical models.
- A Master's or Ph.D. Students in Electrical, Control, or Computer Engineering are interested in advanced topics such as the data informativity framework, quadratic matrix inequalities, and robust control methods.
- A Faculty Member or Academic Researcher seeking to enhance your understanding of cutting-edge data-driven control theory and its applications in real-world engineering challenges.
- A Professional or Practitioner in Systems and Control aiming to apply data-driven approaches to tackle the complexities of modern engineering systems, where accurate modeling is difficult but data is abundant.

This course is tailored for individuals eager to gain expertise in the state-of-the-art methods of data-based systems and control, with applications across diverse engineering fields.

REGISTRATION PROCESS & PARTICIPATION FEES

LAST DATE OF REGISTRATION: 7TH MARCH 2025

Interested candidates can apply online by filling out the registration form Google form link:

https://forms.gle/yuocnLwPBPwoHseU6

Candidates registering early will be given preference in the shortlisting process.

The participation fees for the course are as follows:

- Participants from abroad: USD 350
- Industry/Research Organizations: INR 20,000
- Academic Institutions: INR 10,000
- Students: INR 5,000
- Students from Host Institute: INR 1,000 (Excludes accommodation and food)

Fee inclusions:

- Instructional materials
- Accommodation (in hostels) and meals
- Access to computers for tutorials and assignments
- Usage of laboratory facilities and equipments
- 24-hour free internet access

Accommodation & Meals:

- Participants opting for accommodation in the guesthouse will be provided with these facilities based on availability. Additional charges will be applied for participants requiring this service.

SELECTION AND MODE OF PAYMENT

Selected candidates will be intimated through e mail. They have to remit the necessary course fee to the Bank as per the details given below.

Account Name: CCE, IIT Mandi

Account No. 7315000100034369

Bank: PNB

Branch: IIT Kamand

Branch Code:

IFSC: PUNB0731500

MICR Code: 175024138

SWIFT Code: PUNBINBBPAR

For any queries regarding registration of the course and accommodation, please contact:

Email: cceoofice@iitmandi.ac.in
Contact: 98579-36000

Centre for Continuing Education

RESOURCE PERSON
INTERNATIONAL FACULTY

M.K. (KANAT) CAMLIBEL

M.K. (Kanat) Camlibel is a distinguished academic specializing in applied mathematics, with a focus on control and piecewise linear dynamical systems. He is currently a full professor at the Bernoulli Institute, University of Groningen, where he has been serving since 2001 in various academic roles. He completed his Ph.D. at Tilburg University in 2001, with a thesis on "Complementarity Methods in the Analysis of Piecewise Linear Dynamical Systems," under the supervision of Prof. Hans Schumacher. His academic journey also includes an M.Sc. (1994) and B.Sc. (1991) in Control and Computer Engineering from Istanbul Technical University. Professor Çamlıbel's research contributions have been recognized with several prestigious awards, including the 2021 IEEE Control Systems Letters Outstanding Paper Award and multiple Teaching Awards at the University of Groningen. His groundbreaking work includes extensions of Willems' fundamental lemma for state-space systems. With a career spanning over two decades, his academic appointments have included roles at Eindhoven University of Technology, Dogus University, and Centrum voor Wiskunde en Informatica (CWI) in Amsterdam. His expertise is reflected in a robust publication record, mentorship of students, and contributions to advancing control systems and mathematical modeling.

HENK VAN WAARDE

Henk van Waarde is an Assistant Professor in the Systems, Control, and Optimization group at the University of Groningen, affiliated with the Bernoulli Institute. He is also a member of the Centre for Data Science and Systems Complexity and the Jan C. Willems Center for Systems and Control. He received his Ph.D. in Systems and Control (cum laude) from the University of Groningen in 2020, earning the EECI Ph.D. Thesis Award. His research focuses on data-driven control, system identification, and experiment design, with applications in networked systems and neuroscience, and connections to machine learning. Dr. van Waarde is a recipient of the 2021 IEEE Control Systems Letters Outstanding Paper Award and the 2023 VENI grant. He serves as an Associate Editor for IEEE Control Systems Letters and actively contributes to leading journals and conferences in the field

GLOBAL INITIATIVE OF ACADEMIC NETWORKS

Indian Institute of Technology Mandi

COORDINATOR

TUSHAR JAIN

Tushar Jain received the degree of Doctor in Control, Identification and Diagnostic from Universite de Lorraine, Nancy, France in 2012. He previously received the degree of M.Tech. in System modeling and control from Indian Institute of Technology (IIT) Roorkee in 2009. From 2013 to 2014 and 2014 to 2015, he was a Post-doc researcher and Academy of Finland researcher respectively in the Research Group of Process Control at Aalto University, Finland. Since 2015, he is with the School of Computing and Electrical Engineering, IIT Mandi. During these last years, his research interest has been mainly concentrated on mathematical control theory, fault tolerant control, fault diagnosis and climate-controlled agriculture. He has received thrice the best paper award for his research work. He has authored a book entitled Active Fault-Tolerant Control Systems: A Behavioral System Theoretic Perspective. He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE).

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COURSE MODULES

- **Day 1: Foundations of Data Informativity**
- Data Informativity Framework
- Controllability and Stabilizability Analysis from Exact Data
- Problem-Solving Session

- **Day 2: State Feedback Design and Noisy Data Framework**
- Stabilizing State Feedback Controllers: Informativity Conditions and Design Methods
- Data Informativity Framework for Noisy Data
- Problem-Solving Session

- **Day 3: Quadratic Matrix Inequalities (QMIs)**
- Schur Complement Method, Solution Existence, and Parametrization
- Dualization and Projection Techniques
- Problem-Solving Session

- **Day 4: Designing Controllers from Noisy Data**
- Stabilizing State Feedback from Noisy Data
- Designing H∞ Controllers from Noisy Data
- Problem-Solving Session with Applications: Aircraft Control, Network Control

- **Day 5: Advanced Control Design from Data**
- Dissipativity Analysis from Noisy Data
- Designing Stabilizing Controllers from Input-Output Data
- Problem-Solving Session with Applications: Aircraft Control, Network Control