

## DISC Winter Course 2022

# Data Learning & Dynamics at the Intersection of Neuroscience and Control

Matin Jafarian and Sérgio Pequito organise a DISC Winter Course on “Data learning & dynamics at the intersection of neuroscience and control”, to be held on March 10 and 11, 2022. The course is planned in a hybrid fashion, with two main lectures at TU Delft and two online seminars. In case of strict Covid measures, the program will be held fully online.

### Abstract

Neuroscience data is becoming readily available, and technological developments are making it collectible in almost real-time. On the one hand, this will enable the generation and validation of models for novel closed-loop control implementations enabling treatments of neurological diseases and disorders (e.g., Alzheimer's, Parkinson's, and epilepsy). On the other hand, these advances will bridge the problems in the health and the engineering domains.

The 2022 winter course seeks to cover recent developments in data learning and dynamic models that enable the study of systems properties from a theoretical point of view. We will look into the fundamentals and advances on the Koopman operator methods and fractional dynamical systems. While the primary motivation behind this program is the applications of the presented tools in the intersection of neuroscience and control, the theoretical techniques can be applied to a broad class of complex systems.

### Program sketch

Day 1: Main lecture by **Alexandre Mauroy** (University of Namur, Belgium) complemented by an online seminar by **Antoine Chaillet** (CentraleSupélec, France)

- Opening talk (M. Jafarian): “Dynamic networks in neuroscience and cognition”
- Lecture (A. Mauroy): “Koopman theory in systems & control”
- Seminar (A. Chaillet): “Closed-loop deep brain stimulation for Parkinson's disease”

Day 2: Main lecture by **Sérgio Pequito** (Delft Univeristy of Technology, NL) complemented by an online seminar by **Paul Bogdan** (University of Southern California, USA)

- Lecture (S. Pequito): “Modeling, analysis, estimation and control of fractional dynamical systems”
- Seminar (P. Bogdan): “Compact yet Accurate Mathematical Modeling of Physiological Systems”
- Closure talk (S. Pequito): “Some thoughts and challenges at the intersection between neuroscience and control”

### Date and Location

The course will take place from Thursday, March 10, until Friday, March 11. The location will hopefully be at Delft University of Technology. Details on the program/location will be announced in 2022.

### Registration and fee

The registration fee for taking or auditing an entire course is € 250. This fee is waived for DISC members. The registration form is available on the DISC course platform. Please note that there is a maximum number of participants for the Winter Course, registrations are processed in order of registration. Please register before March 3rd, 2022.

### Credits

You can obtain 1 ECTS for attending the DISC Winter Course. Please note that you have to be present at all Thursday and Friday sessions to receive the credits.

### Further information

For more information, please contact the DISC secretariat ([secr@disc.tudelft.nl](mailto:secr@disc.tudelft.nl)) or the organizers [m.jafarian@tudelft.nl](mailto:m.jafarian@tudelft.nl), [sergio.pequito@tudelft.nl](mailto:sergio.pequito@tudelft.nl).