

# Advanced Process Data Analytics Course

## Course Host



**Massimo Morbidelli**, Professor at Institute of Chemistry and Applied Biosciences (ICB), ETH Zurich.

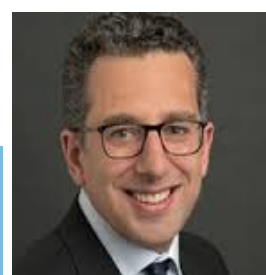
A pioneer in modeling chemical and separation processes as well in continuous integrated bioprocessing, Prof. Morbidelli has co-authored over 600 research articles and four books. He serves as associate editor for the Industrial & Engineering Chemical Research journal of the ACS and is the recipient of the 2005 RH Wilhelm award from the AIChE and of the 2014 Gerhard Damkoehler medal of DECHEMA.

## Course Lecturers



**Michael Sokolov, Ph.D.**, COO at DataHow and Lecturer at ICB, ETH Zurich  
Expert on bioprocess data analytics

**Alessandro Butté, Ph.D.**, CEO at DataHow and Lecturer at ICB, ETH Zurich  
Expert on hybrid process modelling



**Moritz von Stosch, Ph.D.**, Senior manager Fermentation at GSK Vaccines, Belgium  
Expert on hybrid process modeling

**Gianmarco Polotti, Ph.D.**, Process Modeling Specialist at DataHow,  
Expert on chemical process data analytics



**Fabian Feidl**, Co-founder DataHow and Ph.D Candidate at ICB,  
Expert on spectral data analytics

**Joao Almeida**, Data Analytics Specialist at DataHow,  
Expert on machine and deep learning



## Course Co-organizers

**Alexia Bechtold**, ETH Zürich

## Supervisors and Tutors

**Martin Luna**, Postdoctoral fellow

**Harini Narayanan**, Ph.D. Candidate

## Preliminary Program

### Monday, June 3<sup>rd</sup>: Optional Pre-Course

#### 13:30 – 18:30 Introduction into Multivariate Methods

- Lecture: Motivation for multivariate techniques in process industry
- Theory: Data unfolding, process data specialties
- Theory and Industry Examples: PCA, pre-processing, missing data treatment
- Hands-on Case Study 1 (HCS1): PCA for biosimilarity evaluation
- Theory and Industry Examples: MLR, PCR, PLSR
- HCS2: Predictive process modeling and model interpretation

#### 18:30 – Social Program

### Tuesday, June 4<sup>th</sup>: Advanced Course Day 1

#### 9:00 – 12:30 Advanced Data Analytics in the Processing Industry

- Lecture: Role of Big Data and Digitalization in Chemistry and Biotech
- Lecture: Software landscape for process digitalization
- Theory and Industry Examples: Advanced regression models
- HCS3: Generation and comparison of different predictive process models
- Theory: Machine learning versus Multivariate Analysis

#### 13:30 – 18:00 Utilization of Spectral and Online Data

- Theory and Industry Examples: Process Monitoring
- Theory and Industry Examples: Spectral data analysis
- HCS4: Raman spectroscopy in bioprocessing
- Theory, Examples and Lab tour: Integrated continuous bioprocessing
- Lecture: Predictive Maintenance

#### 18:00 – Social Program

### Wednesday, June 5<sup>th</sup>: Advanced Course Day 2

#### 8:30 – 12:30 Combination of Data- and Knowledge-driven Approaches

- Brainstorming Session: Solving Participants' Use Cases
- Theory and Industry Examples: Hybrid Process Modeling
- HCS5: Hybrid modeling for Upstream Bioprocessing
- Theory and Industry Examples: Kalman filtering in Downstream Bioprocessing

#### 13:30 – 18:00 Model-based decision taking and operations

- Theory and Industry Examples: Model-based experimental design
- HCS6: Model-based process optimization
- Theory and Examples: Model robustness and transferability
- HCS7: Extrapolation capability of different predictive process models
- Lecture: Model-based bioprocess control and robotics

#### 18:00 – Social Program

Course venue: ETH Zurich, Hönggerberg, HCI building (1<sup>st</sup> finger of chemistry faculty), Room G 274

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