



Hosted by our FAU MoD, the **#MLPDES25 workshop** is an international event that brings together researchers from Europe and the United States to explore the deepening connection between Machine Learning (ML) and Partial Differential Equations (PDEs). With participants from diverse backgrounds, this event aims to establish a collaborative platform for experts to network, share insights, and drive progress in these exciting fields.

We will dive into recent theoretical advancements and applications, while also discussing ongoing challenges in areas such as:

- Control and PDE methods for universal approximation and data classification
- Mean field analysis of Neural Networks
- ML applications in traffic flow modeling and autonomous driving
- ML and numerical simulation in bio-mechanics and micro-fluidics



Machine Learning and PDEs

#MLPDES25 WORKSHOP

April 28 - 30, 2025

ERLANGEN - BAVARIA, GERMANY



WHEN

Mon.-Wed. April 28 - 30, 2025
09:00H - 17:00H

WHERE

Onsite. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg
Senatssaal (Senate Hall) im Kollegienhaus
Universitätsstraße 15, 91054 Erlangen - Bavaria, Germany

Online (live streaming): <https://www.fau.tv/fau-mod-livestream-2025>

REGISTRATION

Free but mandatory.
Registration form: www.dcn.nat.fau.eu/mlpdes25-registration



www.mod.fau.eu/mlpdes25

SCIENTIFIC COMMITTEE

- Giuseppe Maria Coclite. Politecnico di Bari
- Enrique Zuazua. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg

ORGANIZING COMMITTEE

- Darlis Bracho Tudares. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg
- Nicola De Nitti. Università di Pisa
- Lorenzo Liverani. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg

AUDIENCE

This international workshop is open to: Public, Students, Postdocs, Professors, Faculty, Alumni and the scientific community all around the world.



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#MLPDES25 Schedule • Time table

	MON. APRIL 28, 2025	TUE. APRIL 29, 2025	WED. APRIL 30, 2025
09:30H 10:00H	Registration Opening ceremony	Gabriel Peyré. CNRS, ENS-PSL Transformers are universal in-context learners	Juncheng Wei. CUHK On Brezis's first open problem: A complete solution
10:00H 10:30H	Paola Antonietti. Polimi Machine Learning enhanced polytopal finite element methods for neurodegenerative disorder modeling	Gianluca Orlando. Poliba Replicator dynamics as the large-population limit of a multi- strategy discrete Moran process	Francesco Regazzoni. Polimi Discovering the hidden low- dimensional dynamics of time- dependent PDEs with latent dynamics networks
10:30H	COFFEE / TEA BREAK		
11:00H 11:30H	Daniel Tenbrinck. FAU Eigenvalue problems on graphs and hypergraphs	Alessandro Coclite. Poliba Replicator dynamics on a network	Daniela Tonon. UNIPD Hamilton-Jacobi equations on infinite dimensional spaces
11:30H 12:00H	Camilla Nobili. Surrey Quantification of enhanced dissipation and mixing for time-dependent shear flows	Borjan Geshkovski. Inria S. Many-particle systems perspective on Transformers	Miroslav Krstic. UC San Diego Neural Operators: Implementation enablers for PDE control
12:00H	LUNCH BREAK		
14:30H 15:00H	Paola Goatin. Inria S.A. Modern calibration strategies for macroscopic traffic flow models	Domènec Ruiz-Balet. Imperial Some remarks on matching measures with Machine Learning architectures	Anne Koelewijn. FAU SSPINNpose: Self-supervised learning of biomechanical variables without ground truth
15:00H 15:30H	Michele Palladino. UAQ Handling uncertainty in optimal control	Alessio Porretta. UNIROMA2 Diffusion effects in optimal transport and mean-field planning models	Wei Zhu. Georgia Tech Structure-Preserving Machine Learning and Data-Driven structure discovery
15:30H	COFFEE / TEA BREAK		
16:00H 16:30H	Alexander Keimer. Rostock Optimal control of nonlocal conservation laws and the singular limit	Yaoyu Zhang. SJTU The condensation phenomenon of Deep Neural Networks	Giovanni Fantuzzi. FAU Data-driven system analysis: Polynomial optimization meets Koopman
16:30H 17:00H	Fariba Fahroo. AFOSR Felix J. Kutson. AFOSR Challenges & opportunities at AFOSR	20:00H SOCIAL DINNER	
17:00H	Lorenzo Liverani. FAU Projects and opportunities at the Chair for Dynamics, Control, Machine Learning and Numerics	Closing ceremony	

WHERE

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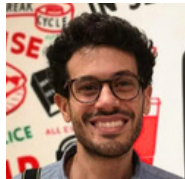
#MLPDES25 WORKSHOP

Program DAY 1 • Mon. April 28, 2025

09:30H	Registration. Opening ceremony	
10:00H 10:30H		<p>Paola Antonietti Politecnico di Milano</p> <p>Machine learning enhanced polytopal finite element methods for neurodegenerative disorder modeling</p>
10:30H	COFFEE / TEA BREAK	
11:00H 11:30H		<p>Daniel Tenbrinck FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg</p> <p>Eigenvalue problems on graphs and hypergraphs</p>
11:30H 12:00H		<p>Camilla Nobili University of Surrey</p> <p>Quantification of enhanced dissipation and mixing for time-dependent shear flows</p>
12:00H	LUNCH BREAK	
14:30H 15:00H		<p>Paola Goatin Inria Sophia-Antipolis</p> <p>Modern calibration strategies for macroscopic traffic flow models</p>
15:00H 15:30H		<p>Michele Palladino Università degli Studi dell'Aquila</p> <p>Handling uncertainty in optimal control</p>
15:30H	COFFEE / TEA BREAK	
16:00H 16:30H		<p>Alexander Keimer Universität Rostock</p> <p>Optimal control of nonlocal conservation laws and the singular limit</p>
16:30H 17:00H	 	<p>Fariba Fahroo • Felix J. Knutson AFOSR, Air Force Office of Scientific Research</p> <p>Challenges and opportunities at AFOSR</p>
17:00H		<p>Lorenzo Liverani FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg</p> <p>Projects and opportunities at the Chair for Dynamics, Control, Machine Learning and Numerics</p>

Machine Learning and PDEs
#MLPDES25 WORKSHOP**Program DAY 2 • Tue. April 29, 2025**09:30H
10:00H**Gabriel Peyré****CNRS, ENS-PSL**

Transformers are universal in-context learners

10:00H
10:30H**Gianluca Orlando****Politecnico di Bari**

Replicator dynamics as the large-population limit of a multi-strategy discrete Moran process

10:30H

COFFEE / TEA BREAK11:00H
11:30H**Alessandro Coclite****Politecnico di Bari**

Replicator dynamics on a network

11:30H
12:00H**Borjan Geshkovski****Inria, Sorbonne Université**

Many-particle systems perspective on Transformers

12:00H

LUNCH BREAK14:30H
15:00H**Domènec Ruiz-Balet****Imperial College London**

Some remarks on matching measures with Machine Learning architectures

15:00H
15:30H**Alessio Porretta****Università di Roma Tor Vergata**

Diffusion effects in optimal transport and mean-field planning models

15:30H






COFFEE / TEA BREAK16:00H
16:30H**Yaoyu Zhang****Shanghai Jiao Tong University**

The condensation phenomenon of Deep Neural Networks


20:00H


SOCIAL DINNER


Program DAY 3 • Wed. April 30, 2025


09:30H 10:00H		Juncheng Wei Chinese University of Hong Kong On Brezis's first open problem: a complete solution
10:00H 10:30H		Francesco Regazzoni Politecnico di Milano Discovering the hidden low-dimensional dynamics of time-dependent PDEs with latent dynamics networks
10:30H	COFFEE / TEA BREAK	
11:00H 11:30H		Daniela Tonon Università di Padova Hamilton-Jacobi equations on infinite dimensional spaces
11:30H 12:00H		Miroslav Krstic University of California San Diego Neural Operators: Implementation enablers for PDE control
12:00H	LUNCH BREAK	
14:30H 15:00H		Anne Koelewijn FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg SSPINNpose: Self-supervised learning of biomechanical variables without ground truth
15:00H 15:30H		Wei Zhu Georgia Institute of Technology Structure-Preserving Machine Learning and Data-Driven structure discovery
15:30H 16:00H		Giovanni Fantuzzi FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg Data-driven system analysis: Polynomial optimization meets Koopman
16:00H	Closing ceremony	


Quick-info

 Cauerstraße 11, 91058 Erlangen

 Felix Klein building. 3rd. floor

 +49 9131 85-67133

 dcn-avh@fau.de

 +49 174 198-9775 (urgencies)


#MLPDES25 website


www.mod.fau.eu/events/mlpdes25

Registration #MLPDES25

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How to get to Erlangen?


 **By taxi.** The best choice. Expect to pay: 35 EUR – 40 EUR approx. for one trip (Duration: 15 mins.)

 **By bus.** Take Bus N° 30. Frequency: 20-30 mins. Expect to pay: 02 EUR – 04 EUR (Duration: 30 mins.)
Tickets for local public transportation can be purchased at the Customer Service Offices of the transportation companies or from ticket machines at major stops.


How to get to our FAU DCN-AvH Chair office?

From the main train station (in the center of Erlangen) you can get to our office at Cauerstrasse:

 **By taxi.** 15EUR–20EUR approx. (one trip, from center to the FAU's Department Mathematik
Duration: 10-15 mins.)

 **By bike/car.** Coming by bike/car? In front of the building you will find a huge parking lot available!
([gMaps directions](#))

 **By foot.** Distance: 4Kms. approx. from the downtown to our building. Expect to walk: 45 mins.

 **By bus.** Please take **bus N° 20** at the Erlangen Arcaden center (3 mins by walk from the main train station).

Go off the bus at "Technische Fakultät" stop. (11 stops later)


Frequency: 20 mins. Expect to pay: 02 EUR – 02.50 EUR (Duration: 15mins)

Other options (bus): Taking N° 287 or N° 293 from the main bus station (Bahnhofplatz 1, city center).

Frequency: 20 – 30 mins (Duration: 25 – 30mins.)

Hotels


 [Hotel Altmanns Stube](#)


 [A.B. Hotel](#)

 [NIU Cure](#)

Apartments

 [Zeitwohnhaus](#)

 [NIU Cure – Hipster Studio](#)

 [Hotel Kral – Wohnen auf Zeit](#)

Restaurants

 [Steinbachbräu \(Brewhouse\)](#)

 [Alter Simpl \(Franconian\)](#)

 [Spezerei \(Franconian\)](#)



Friedrich-Alexander-Universität
Research Center for
Mathematics of Data | MoD

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Alexander von
HUMBOLDT
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Friedrich-Alexander-Universität
DYNAMICS, CONTROL,
MACHINE LEARNING
AND NUMERICS



Politecnico
di Bari