



**SPRING 2024**

# **RENSSELAER POLYTECHNIC INSTITUTE**

**DEPARTMENT OF MATHEMATICAL SCIENCES COLLOQUIUM**

**Mathias Oster (RWTH Aachen University)**

**February 22, 2024 - 4pm**

**PITTS 4114**

## **On Semi-global Optimal Control and its Application to Machine Learning**

We seek to learn a function by deep neural networks. An abstract optimal control problem with measure-valued controls provides an interesting mathematical framework to analyse the expressivity and optimization of such networks from a continuous point of view. This control problem can be seen as an infinite deep neural network where the last layer is of a special form. We exploit the ideas of Barron spaces as continuous interpretation of infinite wide shallow networks and neural ODEs as infinite deep residual network architectures.

We show the existence of minimizers to the optimal control problem by using Prokhorov's theorem on tight measures and some regularity assumptions on the activation function. Secondly, we analyse corresponding gradient flows in the space of probability measures endowed with the Wasserstein metric.

*Refreshments served at 3:30pm 4<sup>th</sup> floor Lounge – Amos Eaton*

## Biographical Sketch

Mathias Oster is a PostDoc at the Institute for Geometry and Practical Mathematics at RWTH Aachen. He received his PhD in mathematics from the Technical University Berlin in 2023.

Oster is interested in high-dimensional optimal control problems and their application in machine learning. Therein he focused on applying tensor decomposition techniques and neural network methods to overcome the curse of dimensionality.



Mathias Oster

Institute for Geometry and Practical Mathematics - RWTH Aachen

[oster@igpm.rwth-aachen.de](mailto:oster@igpm.rwth-aachen.de)