

# Pedro L. Ferreira

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## ABOUT ME

Hi, I'm Pedro Ferreira. Since 2021, I've been a PhD candidate at the Delft Center for Systems and Control (DCSC), which is a part of the Delft University of Technology (TUDelft) in the Netherlands.

I am generally interested in solving problems related to decision-making under uncertainty. This uncertainty and risk comes not only from an inherently stochastic or largely unpredictable environment but also from other agents who are also learning to solve such problems. Interestingly, the tools employed to solve these problems come from a wide range of scientific disciplines (e.g. stochastic processes and game theory) which allows me to learn concepts well outside my training, a perk of the job I find very rewarding.

The main focus of my research is gaining a fundamental understanding of how distributionally robust approaches to optimization can be applied in control settings. This is a very broad subject that can be applied to several other areas such as the financial sector by measuring, predicting, and informing action under risk, to sociology in understanding how society responds to a worldwide pandemic.

I have a MSc degree in Applied Mathematics and a BSc in Engineering Physics from Instituto Superior Técnico (University of Lisbon).

## RESEARCH INTERESTS:

- Control Theory
- Machine Learning & Data-Driven Methods
- Distributionally Robust Optimization
- Optimization on Manifolds
- Dynamical Systems
- Data-Driven Methods

## PROGRAMMING LANGUAGES, FRAMEWORKS, AND OTHER SKILLS:

- Programming (C/C++)
- Computing (Mathematica)
- Data Science (Python)
- Front-End (HTML5/CSS3/JS)
- Back-End (PHP/MySQL/WP)
- Deep Learning (Pytorch)
- NLP (NLTK)
- Web Scraping (BS4)
- Game Dev (C#/GDScript)
- Version Control (GIT)
- Writing (LaTeX)
- Vector Art (Inkscape)

## PROFESSIONAL EXPERIENCE

### PHD, DISTRIBUTIONALLY ROBUST CONTROL

2021-2025 (expected)

*Delft University of Technology, Delft, NL.*

On the topic of distributionally robust control of dynamical systems, supervised by Prof. Peyman Mohajerin Esfahani. I'm a part of the Networked Cyber-Physical Systems research group, which is a part of the Faculty of Mechanical, Maritime and Materials Engineering (3mE, for short), in the Delft University of Technology (TUDelft, also for short). My research is funded by ERC Starting Grant "Control without Trust: A Distributionally Robust Approach", awarded to my supervisor.

### TEACHING ASSISTANT

2021-current

*Delft University of Technology, Delft, NL.*

Assisted teaching of Dynamic Programming and Stochastic Control, with Prof. Peyman Mohajerin Esfahani. The course covered the basic models and solution techniques for problems of sequential decision making under uncertainty (stochastic control). The course introduced dynamic models of random phenomena, and in particular, the most popular classes of such models: Markov chains and Markov decision processes. Then we considered optimal control of a dynamical system over both a finite and an infinite number of stages, control of systems with finite or infinite state spaces, and control of perfectly or imperfectly observed systems.

	<b>TEACHING ASSISTANT</b>	2020-2021
	<i>Instituto Superior Técnico, Lisbon, PT.</i>	
	Assisted teaching of Network Science, with Prof. Francisco C. Santos. The course introduced basic concepts in complex systems and network science, as well as algorithmic strategies to handle characterization of large networks. The course finished off by introducing dynamical and stochastic processes on networks, and touched on network-centric models of real phenomena such as disease spreading, reliability of power distribution networks, peer-influence and opinion formation, and game-theoretical population dynamics.	
	<b>FULL-STACK WEB DEVELOPER</b>	2019-2020
	Automated systems for digital advertising. Webpage template elements are built using regular front-end tools, and are combined with back-end scripts based on user-specified rules to create full web-pages. Traffic is then redirected to each webpage from various sources controlled by AI and user-specified rules.	
	<b>RESEARCHER</b>	2019
	<i>INESC-ID, Lisbon, PT.</i>	
	Grant from <i>Instituto de Engenharia de Sistemas e Computadores - Investigação e Desenvolvimento</i> (INESC-ID). Studied the cooperation between countries in climate change agreements using evolutionary game theory based on behavioral decision models from psychology and economic theories of value. Research was supervised by Prof. Francisco C. Santos.	
	<b>RESEARCH SCHOLAR</b>	2019
	<i>Rensselaer Polytechnic Institute, NY, USA.</i>	
	Invited by Prof. Sérgio Pequito to write the master thesis abroad as a visiting researcher at the Department of Industrial and Systems Engineering of Rensselaer Polytechnic Institute.	
	<b>PRIVATE TUTOR</b>	2017-2018
	<i>Lisbon, PT.</i>	
	Tutored several high school- and university-level students, individually, in Electromagnetism, Calculus and Linear Algebra.	
	<b>INTERN AT COSMIC RAY LABORATORY, LIP</b>	2016
	<i>Instituto Superior Técnico, Lisbon, PT.</i>	
	Worked towards a C++ computational tool to aid signal forecasting and particle detection using scintillation and Cerenkov radiation in the SNO+ neutrino experiment, designed to look for neutrinoless double beta decay. Internship offered by LIP with Prof. Fernando Barão.	
<b>SCIENTIFIC PUBLICATIONS</b>	<b>Risk Sensitivity and Theory of Mind in Human Coordination</b> <i>Pedro L. Ferreira, Francisco C. Santos, Sérgio Pequito, Under review.</i>	2021
<b>ACADEMIC SEMINARS</b>	<b>Homo Ex Machina: The Man from the Machine</b> Department of Physics and Mathematics, Instituto Superior Técnico, University of Lisbon.	2019
<b>EDUCATION</b>	<b>MSC, APPLIED MATHEMATICS</b> <i>Instituto Superior Técnico, Lisbon, PT.</i> Majored in Probability and Statistics. MSc thesis focused on understanding emergence of human coordination using behavioral decision models and theory of mind. Thesis supervised by Prof. Francisco C. Santos, from IST, and Prof. Sérgio Pequito, from Rensselaer Polytechnic Institute, NY. <b>Defended thesis was awarded with a grade of 19/20</b> , finishing my degree with a grade of 17/20.	2017-2019
	<b>Courses:</b>	

- Complex Networks
- Deep Structured Machine Learning
- Learning and Intelligent Decision-Making
- Machine Learning
- Mathematical Statistics
- Statistical Methods in Data Mining

- Introduction to Stochastic Processes
- Time Series Analysis
- Probability Theory
- Computability and Complexity
- Reliability and Quality Control

## **BSC, ENGINEERING PHYSICS**

2014-2017

*Instituto Superior Técnico, Lisbon, PT.*

Provided me with unique first principles reasoning, and analysis and modeling tools which have served me greatly in other fields. I finished my BSc degree with a grade of 15/20.

### **Courses:**

- Linear Algebra
- Programming
- Innovation and Development Laboratory
- Techniques of Mathematical Physics
- General Mechanics
- Computational Physics
- Oscillations and Waves Laboratory
- Advanced Experimental Physics Laboratory
- Quantum Mechanics I
- Complex Analysis and Differential Equations
- Analytical Mechanics
- Mechanics and Waves
- Computational Mathematics
- Electromagnetism and Optics
- Electromagnetism and Thermodynamics Laboratory
- Atomic Physics, Optics and Radiation Physics Laboratory
- Management
- Quantum Mechanics II
- Solid State Physics
- Basic Experimental Physics
- Digital Systems
- Probabilistic and Statistics
- Technological Laboratory
- Circuits Theory and Electronic Fundamentals
- Thermodynamics and Structure of Matter
- Classical Electrodynamics
- Physics of Continuous Media
- Statistical Physics