

# Alvaro Perez-Diaz

## PERSONAL DETAILS

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<i>Birthdate</i>	December, 1990
<i>Nationality</i>	Spanish
<i>Address</i>	AIC, Building 32, University of Southampton, SO17 1BJ, UK
<i>Phone number</i>	<i>on request</i>
<i>Mail</i>	cv@alvarop.me

## EDUCATION

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**Ph.D. Program. Next Generation Computational Modelling** 2015-2019

*University of Southampton (UK)*

Supervisors: Dr Enrico Gerding and Professor Frank McGroarty

Four year program consisting on a taught master year followed by three years of research.

**Major thesis:** my research focuses on the integration of large fleets of electric vehicles (EVs) into the existing power systems infrastructure. During my first year I developed a price-maker day-ahead bidding algorithm for large EV aggregators, which improves the state-of-the-art bidding algorithms by considering price impact as a computationally tractable optimisation problem. Also, I designed a mechanism design framework to allow for cooperation of self-interested EV aggregators competing in the same day-ahead market. By employing a Vickrey-Clarkes-Groves mechanism, each participating EV aggregator will quasi-truthfully report its real preferences to a third-party coordinator who will bid on their behalf and distribute the purchased energy among the aggregators achieving greatly reduced costs. In the second year, I studied the previously described coordination setting under the perspective of cooperative game theory. We proved that the multi-aggregator scenario is balanced, and hence full cooperation is the most beneficial strategy for all the aggregators. Two payment distribution mechanisms we studied, the Shapley Value and the Least-Core, providing computationally tractable ways of distributing payments. Next, the issues of price and driving pattern forecasting will be addressed, both key components to successful participation in electricity markets. Machine Learning presents itself as a promising candidate for this task.

**Minor thesis:** three-month project looking at ways to improve the ways that programming can be taught to young learners by gamification using Python and Minecraft. I developed a Minecraft modification (*mod*) in Java, Python-Tool Mod , to allow interactive execution of Python scripts that alter the virtual world in real time. This software has been used for outreach purposes in science festivals and centres in the UK. For more information, see Publications section.

Research Interests: Multi-Agent Systems, Electric Vehicle Aggregation, Mathematical Optimisation, Game Theory, Mechanism Design, Forecasting, Machine Learning.

### MSc Complex Adaptive Systems

**2nd year Erasmus Mundus Master in Complex Systems Science** 2014-2015

*Chalmers University of Technology (Sweden)*

First Class Honours.

**Modules included:** Game theory, Simulation of Complex Systems, Quantum Physics and Scientific Visualisation.

**Master Thesis:** The Minority Game: evolution of strategy scores. Supervisor: Dr Mats Granath.

<http://publications.lib.chalmers.se/records/fulltext/220180/220180.pdf>

### MSc Complexity Science

**1st year Erasmus Mundus Master in Complex Systems Science** 2013-2014  
*University of Warwick (UK)*

First Class Honours.

**Modules included:** Mathematical Networks, Dynamical Systems, Self-organisation and Chaos, Statistical Mechanics, Machine Learning, Statistics.

**Master Thesis:** Ultrasonic transducers: From analytical modelling to design optimisation and validation. Supervisor: Dr Nishal Ramadas.

[https://www2.warwick.ac.uk/fac/cross\\_fac/complexity/study/emmc/outcomes/studentprojects/perez\\_diaz\\_m1.pdf](https://www2.warwick.ac.uk/fac/cross_fac/complexity/study/emmc/outcomes/studentprojects/perez_diaz_m1.pdf)

**MPhys. Fundamental Physics** 2009-2015  
*Universidad Nacional de Educación a Distancia (Spain)*

Upper Second Class Honours.

**Modules included:** Classical Mechanics, General Relativity, Quantum Mechanics, Solid State Physics, Statistical Mechanics, Electromagnetism, Electronics.

**Erasmus Exchange Program in Mathematics** 2011-2012  
*University of Manchester (UK)*

First Class Honours.

**Modules included:** Partial Differential Equations, Differentiable Manifolds, Algebraic Topology, Functional Analysis, Fluid Dynamics, Set Theory.

**Thesis:** Categories, Functors and Natural Transformations. Supervisor: Professor Mike Prest.

**MMath. Mathematics** 2008-2013  
*Universidad Complutense de Madrid (Spain)*

First Class Honours.

**Modules included:** Linear Algebra, Real and Complex Calculus, Group Theory, Differential Equations, Numerical Methods, Algebraic Geometry.

## **PUBLICATIONS**

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Journal papers:

- Perez-Diaz, A., Gerding, E., McGroarty F. *Coordination and payment mechanisms for electric vehicle aggregators*. Applied Energy, 212:185-195 (2018).
- Granath, M. and Perez-Diaz, A. *Diffusion and localization of relative strategy scores in the Minority Game*. Journal of Statistical Physics, 165(1):94-114 (2016).

Conference papers:

- Perez-Diaz, A., Gerding, E., McGroarty F. *Coordination of Electric Vehicle Aggregators: A Coalitional Approach*. In Proc. of the 17th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2018).
- Perez-Diaz, A. *Coordination of Electric Vehicle Aggregator Participation in the Day-Ahead Market*. In Proc. of the 17th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2018). Doctoral Consortium.

Software:

- Perez-Diaz, A. and Fangohr, H. PythonTool-Mod for Minecraft: developing programming skills with Minecraft & Python (2016). DOI: 10.5281/zenodo.801627  
<https://github.com/ngcm/PythonTool-Mod>

## **ADDITIONAL EDUCATION**

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<b>Introduction to Pandas (Python)</b> <i>University of Southampton, NGCM Summer school</i>	June 2017
<b>Introduction to Scikit-learn (Python)</b> <i>University of Southampton, NGCM Summer school</i>	June 2017
<b>Introduction to C++ Programming</b> <i>University of Southampton, Jacek Generowicz</i>	Oct 2016
<b>Programming the Intel Phi</b> <i>University of Southampton, NGCM Summer school</i>	June 2016
<b>GPU Programming Using CUDA</b> <i>University of Southampton, NGCM Summer school</i>	June 2016
<b>Project Planning and Management</b> <i>University of Southampton &amp; Boeing UK</i>	April 2016
<b>Parallel Programming with OpenMP</b> <i>University of Southampton &amp; ARCHER</i>	April 2016
<b>Parallel Programming with MPI</b> <i>University of Southampton &amp; ARCHER</i>	April 2016
<b>Control of Mobile Robots</b> <i>Coursera (Georgia Institute of Technology)</i>	March 2013
<b>Creative Programming for Digital Media &amp; Mobile Apps</b> <i>Coursera (University of London)</i>	Sept 2013

## **AWARDS, SCHOLARSHIPS, AND GRANTS**

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<b>AAMAS 2018 Student Scholarship</b>	2018
<b>19th European Agent Systems Summer School Scholarship</b>	2017
<b>Best New Outreach Activity Award</b> University of Southampton Science and Engineering Festival. Awarded to the three NGCM activities including PythonTool-Mod for Minecraft: developing programming skills with Minecraft & Python.	March 2017
<b>UK EPSRC International Doctoral Scholarship</b>	2015-2019
<b>EU EACEA Postgraduate Scholarship</b>	2015
<b>Fundación Mutua Madrileña Postgraduate Scholarship</b>	2013-2015
<b>EU Erasmus Exchange Scholarship</b>	2011-2012

## **CONFERENCES, SUMMER SCHOOLS, PRESENTATIONS AND EVENTS ATTENDED**

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<b>19th European Agent Systems Summer School</b> <i>University of Gdańsk (Poland)</i>	August 2017
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<b>NGCM Strategic Advisory Board 2016</b> <i>University of Southampton (UK)</i> Gave <b>presentation</b> : <i>Developing Programming Skills with Minecraft &amp; Python</i> Presented <b>poster</b> : <i>Agent-Based Modelling of High-Frequency Trading</i>	Nov 2016
<b>Southampton Python User Group</b> <i>University of Southampton (UK)</i> Gave <b>presentation</b> : <i>Continuous Integration using CircleCI</i> , together with Ryan Pepper.	Aug 2016
<b>EuroPython 2016</b> <i>Euskalduna Conference Center (Spain)</i>	July 2016
<b>NGCM Summer School 2016</b> <i>University of Southampton (UK)</i> Presented <b>poster</b> : <i>Agent-Based Modelling of High-Frequency Trading</i>	June 2016
<b>NGCM Strategic Advisory Board 2015</b> <i>University of Southampton (UK)</i> Gave <b>presentation</b> : <i>Agent-Based Modelling of High-Frequency Trading</i>	Nov 2015
<b>Student Conference on Complexity Science SCCS 2014</b> <i>University of Sussex (UK)</i>	Aug 2014
<b>Erasmus Mundus Summer School on Networks</b> <i>Chalmers University of Technology (Sweden)</i> Gave <b>presentation</b> : <i>Ultrasonic transducers: From analytical modelling to design optimisation and validation.</i>	June 2014

## OTHER CONTRIBUTIONS

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<b>NGCM Summer Academy 2017</b> <i>University of Southampton (UK)</i> Part of the organising committee: general management.	June 2017
<b>Academic Paper Reviews</b> I have sub-reviewed several papers in top journals and conferences, such as Applied Energy, AAMAS and AAAI.	

## TEACHING

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<b>Outreach Activity: PythonTool-Mod for Minecraft: developing programming skills with Minecraft &amp; Python</b> <i>University of Southampton Science and Engineering Festival (UK)</i>	March 2017
<b>Outreach Activity: PythonTool-Mod for Minecraft: developing programming skills with Minecraft &amp; Python</b> <i>Winchester Science Centre (UK)</i>	Feb 2017
<b>Beginner Python Programming Workshop</b> <i>University of Southampton (UK)</i> Helped as a demonstrator.	May 2016
<b>Beginner Python Programming</b> <i>NGCM Summer Academy 2016, University of Southampton (UK)</i> Helped as a demonstrator.	June 2016
<b>Version Control</b>	June 2016

*NGCM Summer Academy 2016, University of Southampton (UK)*

Helped as a demonstrator.

**Continuous Integration Workshop**

Feb 2016

*University of Southampton (UK)*

Seminar leader together with Ryan Pepper.

**Postgraduate Demonstrator**

2016-

*University of Southampton (UK)*

Demonstrator for undergraduate problem sessions and tutorials, for various courses.

## **SKILLS**

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<i>Languages</i>	Spanish (mother tongue) English (fluent) French (intermediate)
<i>Programming</i>	PYTHON, C, JAVA, R, MATLAB
<i>Teaching</i>	Postgraduate Demonstrator. Regularly supervise undergraduate problem sessions and tutorials, and mark assignments.
<i>Other</i>	Knowledge of research methodologies Knowledge of technical writing Knowledge of presentation skills

## **REFERENCES**

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**Associate Professor Enrico Gerding**

Department of Electronics and Computer Science, University of Southampton, SO17 1BJ, United Kingdom.

**Professor Frank McGroarty**

Southampton Business School, University of Southampton, SO17 1BJ, United Kingdom.