

Curriculum Vitae

Martina Fischetti

Industrial PhD at DTU and Vattenfall



PROFILE

I'm currently an Industrial PhD student at Technical University of Denmark, with M.Sc. degrees from the University of Padova (March 2014), and from the University of Aalborg (June 2014). During my studies I've discovered my interest in Operation Research, in particular with application in Wind Energy and Machine Learning.

Since January 2015 I've worked on a PhD project on green energy problems together with Technical University of Denmark (DTU Management Engineering) and Vattenfall, a leading energy company in North Europe. Thanks to this close collaboration, I was able to study some new problems arising in practical application, in particular in the wind farm design process. This gave me also the opportunity to interact with people from different backgrounds.

In the last year of my PhD, I've discovered my interest in applications of Machine Learning together with Operation Research. In this framework I collaborated both with the Machine Learning division in DTU (DTU Compute), and with the research group GERAD, Polytechnique Montréal, Canada.

I've presented my PhD work in different international conferences and on journal papers.

I consider myself a creative and polyhedric person, with interests that go from poetry to math. Art and travelling always had a great part in my life--I really love to get in touch with different points of view and ideas.

PERSONAL DATA

Date of birth 10th June 1989, Bologna, Italy

Citizenship: Italian

Languages: Italian (mother tongue)
English (work proficient user),
Danish (basic level)

SCIENTIFIC RESULTS

Journal papers:

- Martina Fischetti, and Michele Monaci, **Proximity search heuristics for wind farm optimal layout**, Journal of Heuristics (2016), Volume 22, Issue 4, pp 459–474
- Martina Fischetti, and David Pisinger, **Optimizing wind farm cable routing considering power losses**, European Journal of Operational Research (2017) ISSN 0377-2217, <http://dx.doi.org/10.1016/j.ejor.2017.07.061>
- Martina Fischetti, and David Pisinger, **Optimal wind farm cable routing: modeling branches and offshore transformer modules**, Networks (to appear)
- Martina Fischetti, and David Pisinger, **Mathematical Optimization for offshore wind farm design**, Business & Information Systems Engineering (to appear)
- Martina Fischetti, and Marco Fraccaro, **Machine Learning meets Mathematical Optimization to predict the optimal production of offshore wind parks** (submitted to an international journal).

Book chapters:

- Martina Fischetti, Matteo Fischetti, and Michele Monaci, **Optimal Turbine Allocation for Offshore and Onshore Wind Farms**, Optimization in the Real World, 55-78, Springer Japan, 2015
- Martina Fischetti, and Matteo Fischetti, **Matheuristics**, Handbook of Heuristics, 1-33, Springer, 2016
- Martina Fischetti and David Pisinger, **On the impact of considering power losses while designing offshore wind farm cable routing**, Communications in Computer and Information Science (CCIS), Springer (to appear)

Conference papers:

- Martina Fischetti, Jon-Joseph Leth, and Anders Bech Borchersen , **A Mixed-Integer Linear Programming approach to wind farm layout and inter-array cable routing**, - proceeding of American Control Conference, July 1–3, Chicago, IL, 2015
- Martina Fischetti, David Pisinger, and Iulian Vranceanu, **Inter-array Cable Routing Optimization Considering Power Losses**,– proceeding of 14th Wind Integration Workshop 20 – 22 October, Brussels, Belgium, 2015
- Martina Fischetti and David Pisinger, **Impact of considering power losses in the**

inter-array cable design of wind farms –proceedings of ICORES, 23-25 February, Porto, Portugal, 2017 – winner of **Best Student Paper Award**

- Martina Fischetti, and David Pisinger, **Mixed Integer Linear Programming for new trends in wind farm cable routing**– proceedings of INOC, 26-28 February, Lisboa, Portugal, 2017
- Martina Fischetti, and Marco Fraccaro, **Using OR + AI to predict the optimal production of offshore wind parks: a preliminary study** – proceedings of ODS, 4-7 September, Sorrento, Italy, 2017

OTHER INITIATIVES

2016 Co-founder AIRO Young Research Chapter

AIRO Young Researchers Chapter is part of the Italian Operational Research Society (AIRO). Its aim is to foster collaboration between students and early-career researchers interested in the field of OR, and to provide them with new opportunities to advance their career and expand their network. It also strives to connect the demand and the offer in the OR job market, both in academia and in the industry. It organizes conferences and workshops for young researchers in the OR field.

Website: <https://www.airoyoung.org/>

EDUCATION

2015-2018 Industrial PhD in Operational Research at Technical University of Denmark and Vattenfall

Thesis: Mathematical Programming Models and Algorithms for Offshore Wind Park Design

During my PhD I've worked on Offshore Wind Parks applications of Operational Research. This PhD project was selected by Innovation Fund Denmark for an industrial PhD grant. My PhD was a great opportunity to look into innovative applications of OR in a still very new sector (green energy), not yet very much explored by the OR community. The close collaboration with such an important company as Vattenfall, gave me the opportunity to work with people of different backgrounds, and to develop tools actually used by the company. I've worked on wind farm layout, cable routing, vessel routing for maintenance schedule, and turbine foundations optimization. Most of these problems were really challenging due to their large size, so we used advanced heuristic techniques to solve them. During my PhD I also visited prof. Andrea Lodi at Polytechnique Montréal, Canada. There we collaborated on an innovative application of Machine Learning to general Mathematical Optimization problems (on going research).

All in all, my PhD gave me a very strong competence in designing and testing advanced algorithms for hard optimization problems. I developed the capacity of understanding and modelling new problems, not yet known in the OR community, as well as to discuss with practitioners in the wind energy sector. I obtained great results both from an application

perspective (being able to save millions of euros for the company), and from a research perspective (developing advanced models and algorithms for large-size problems, resulting in a number of publications and a Best Student Paper Award). Participating to several conferences both in the OR and in the Wind Energy community, developed my public-speaking skills and my capacity to adapt my talks to the audience. Conferences, collaborations with different universities, extra-activity (AIROyoung group in particular) and my work in Vattenfall, gave me a quite unique network.

2013-2014 **Master of Science (M.Sc.) in Control and Automation Engineering,**
Department of Electronic Systems, Aalborg University
with grade: 11,2/12

Thesis: Mixed Integer Programming Models and Algorithms for Wind Farm Layout and Cable Routing (in collaboration with Vattenfall)

This thesis extends my previous one, adding the cost of foundations to the offshore Wind Farm Layout optimization and solving the Cable Layout problem. We developed a new tool for cable routing optimization in offshore cases. Given a turbine layout and cable prices, our software is able to find the cable routing that minimizes the total cable cost, taking different constraints into account. The tool implements a Mixed Integer Linear Programming approach to the problem. Our innovative model uses a new formulation and is able to deal with non-crossing constraints, cable capacity limitations, and substation limitations. Validation experiments show that our tool provides significant savings with respect to the layouts found manually.

2011-2014 **Master of Science (M.Sc.) in Automation Engineering,**
Department of Information Engineering, Università degli Studi di Padova
with grade: 110/110 cum laude

Thesis: Mixed Integer Programming Models and Algorithms for Wind Farm Layout (in collaboration with Vattenfall)

The aim of the thesis is to design, implement and test a new approach for optimization of the wind farm layout. The approach consists of using a Mixed Integer Linear Programming model to maximize the expected power output under different types of constraints and different wind scenarios. In particular, given a specific wind farm site and computational fluid dynamic (CFD) output for the site, an optimal location of turbines that maximises the power production is determined by considering turbine proximity constraints and power losses due to wake effect.

2009-2011 **Bachelor in Information Engineering, Università degli Studi di Padova**
with grade 102/110

2003-2008 **High school diploma in classical studies, Liceo Classico Tito Livio, Padova**

PROFESSIONAL EXPERIENCE

2014-2015 **Vattenfall, Fredericia, Denmark**
 Treinee

After my master thesis I worked at Vattenfall in Denmark for a few months. Here I've developed, implemented and tested a mathematical model to optimize wind farm layout and inter array cable routing for real-world cases, considering wake effect and different types of constraints. Given the good results from my master thesis and from this period, we decided to continue this challenging project in the form of an Industrial PhD. This experience improved not only my O.R. skills, but also my knowledge in the wind energy sector. I've developed the capacity of translating real highly-complex problems into mathematical models, being able to interact with different people from different backgrounds and countries.

The program is developed in C (using IBM-ILOG CPLEX solver)

Results: Two original software able to solve two optimization problems of great interest for the company. An inter-array routing optimization tool was available at the company before and my layout optimization tool overcomes the commercial one used in Vattenfall.

2007-2010 **Il mattino di Padova, Padova, Italy**
 Journalist

Working as a journalist for my city newspaper was a great experience. It taught me to work under time pressure and improved my public speaking skills. I wrote articles of different subjects (economy, sport, news, music, culture)

IT-PROFICIENCIES

Technologies: MILP optimization, heuristics, Branch & Bound, LP / IP programming, Proximity Search, Matheuristics, Machine Learning

Programming: Experienced in C (and CPLEX), Matlab, Javascript, Jupyter

SPARE TIME

I'm a creative person and in my spare time I like to express myself through poems, writings, painting and creative hobbies in general. I love to be inspired by the world around me, therefore I love travelling, getting in touch with different realities, visiting modern art museums and music festivals.

REFERENCES

David Pisinger, Professor

My supervisor for the industrial PhD, DTU.
Please refer to him *at pisinger@man.dtu.dk*

Jesper Runge Kristoffersen, Vattenfall Renewables

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My supervisor for the industrial PhD, Vattenfall.
Please refer to him at Jesper.RungeKristoffersen@vattenfall.com

Michele Monaci, Professor

My supervisor for my master thesis, Bologna University.
Please refer to him at michele.monaci@unibo.it