# PHD POSITION ON REINFORCEMENT LEARNING FOR FLEET CONTROL OF WIND TURBINES

***VRIJE UNIVERSITEIT BRUSSEL/OWI-LAB***

## SUPERVISORS

Primary supervisor: Prof. Jan Helsen
Co-supervisor: Prof. Ann Nowé

## THE TEAM

VUB Acoustics and Vibrations Research group and VUB AI-group work closely together in the field of health aware fleet-wide control. Novel AI Reinforcement Learning methods are developed specifically targeted at the control of wind turbine farms. In this context we work closely together with leading companies: Parkwind, Norther, ZF, … The team has a core focus on wind energy in the context of OWI-lab. Our multi-disciplinary approach allows us to bring methodological advancements all the way to application in industry. All research is done on operational data from wind turbines in the Belgian North Sea.

## PROJECT DETAIL

Offshore wind energy is taking an increasingly prominent role in the renewable energy market. Due to their rapid increase in capacity, contemporary wind farms need to adhere to strict regulations on power output to ensure stability of the electricity grid and guarantee a steady supply of energy. Therefore, smart wind farm controllers need to be developed that execute optimal production strategies that generate revenue while being subjected to strict constraints on the energy output. However, due to the uncertain and transient behaviour of the wind resource, this becomes a non-trivial task, as complex dependencies exist between the operational wind turbines. Moreover, optimality of a controller is based on multiple criteria, such as energy market prices, the risk of violating grid constraints and so forth. Due to the complex nature of this optimization problem, Artificial Intelligence-driven methods will be needed.

In this project, you will investigate the use of reinforcement learning techniques in the context of market-price-driven wind farm control under grid constraints. Specifically, you will investigate the use of multi-armed bandit optimization in order to learn and evaluate alternative curtailment strategies, in order to enforce set-points on the power production for each turbine in the farm. The developed methods will be validated in simulation, as well as be used to provide real-time recommendations for set-point configuration to wind farm operators.

## ENTRY REQUIREMENTS

Applicants should preferably have:

- Master degree in Mechanical, Electrical, Mathematical engineering, Statistics or Computer Science or Artificial intelligence
- Experience with or eagerness to learn in one or more of the following will also be an advantage: Shallow Machine Learning, Deep Learning, Gaussian processes, bandit approaches, Bayesian statistics, ...
- Background in programming (Python, Matlab, …)
- Proficiency in English is a plus

## FUNDING INFORMATION

We offer an international open working environment stimulating personal development through international courses, many opportunities to attend and present at conferences abroad. Possibility to spend part of the research abroad. A competitive salary, public transport coverage and health insurance. The PhD normally lasts 4 years.

As a PhD student, you will contribute in designing, developing and deploying a scalable software framework for an advanced AI-assisted wind analytics engine. In this role, you will collaborate with a bright team of software developers, AI engineers and mechanical engineers to develop next-generation wind analytics software, as well as perform research on scalable analytics architectures.

We are looking for creative applicants with a strong passion for wind analytics and AI, having experience in software development, data ingestion pipelines and system management. The ideal candidate for this position will be a reliable and skilled software engineer, who is eager to break down large technical problems and solve them systematically.

## CONTACT

If you are interested, please send your curriculum vitae to Timothy Verstraeten (timothy.verstraeten@vub.be)