



2ND AND 3RD YEAR PROJECT-BASED SPECIALISATION INTERNATIONAL SMALL WIND TURBINE CONTEST

[CICE]

Wind energy extraction systems (onshore and offshore wind turbines) account for 5% of the total energy produced within France's energy mix. Training tomorrow's engineers to have a global understanding of these wind extraction systems is thus a major challenge.

The "International Small Wind Turbine Contest" project-based specialisation involves the participation of a group of Centrale Nantes students in an international competition: the International Small Wind Turbine Contest (ISWTC), organised by the University of Hanze and TUDelft University in the Netherlands.



COURSE CONTENT

Fluid Mechanics Track

- > Wind energy
- > Wind tunnels
- > Atmosphere measurements
- > Blade design

Structures / Materials Track

- > Wind energy II
- > Major challenges of energy transition
- > Blade structure simulation

Automatic Control Track

- > Energy Conversion Chain
- > Advanced control: Application to RE (renewable energies)
- > Wind turbine generator

Students will follow one of the above tracks, courses in 'Managing and Project Undertaking' and 'Machine parts, CAD, manufacturing process'. They will spend the majority of their time on the project itself.



PROJECT-BASED LEARNING

The specialisation will be open to a maximum of 12 students. It is broken down into three parts:

- > the project supervised by the specialisation's supervisor,
- > scientific courses with internal and external lecturers, focusing on the themes that are essential to master in order to carry out the project,
- > scientific monitoring supervised by the specialisation's teaching staff

1. Preparatory work

In order to prepare the CICE specialisation, groups of first and second year students at Centrale Nantes have been working on the subject since 2019. They have produced a small wind turbine rotor (30 cm in diameter) used today in the Wind Energy I course. They have also prepared parts of the larger wind turbine rotor required for the competition (max. 1.6 m in diameter).

2. Objective

The aim is to take part in an international competition to design and manufacture a small wind turbine.

3. Application development

The students in the CICE project will not all follow the same courses, but will specialise in small groups (3 groups of 4 students) according to the three subject areas required to build the wind turbine for the competition.

- > Fluid Mechanics and Energy Track: learn how to evaluate a wind resource, understand and master the aerodynamics of wind turbine blades and rotors and the tools needed to design them, acquire knowledge and experience of the means of evaluating wind turbine performance (wind tunnel).
- > Structure/Materials Track: learn how to evaluate the structural stresses of the various components of a wind turbine and master the structural dimensioning tools associated with wind turbines. Learn about the manufacturing materials used in renewable energy (and if possible more specifically in wind power) and their level of criticality.
- > Automatic Control Track: have a knowledge of the conversion chain of a wind turbine, know how to create a control system based on physical sensors and use the associated tools.

CONTEXT

The aim of the ISWTC contest is to build the most efficient wind turbine with the highest energy output.

The students will work on:

- > a report on the sizing and design of the rotor
- > the environmental commitment of the project,
- > a promotional poster
- > a ten-minute oral presentation to a committee of international experts in the field, as well as leading manufacturers in the sector (VESTAS, GE-LM, etc.)
- > tests in the CSTB wind tunnel in Nantes

SKILLS DEVELOPED

- > Understanding the operation and design of a wind turbine
- > Practical training in multidisciplinary system optimisation.
- > Organising and carrying out a project as part of a multidisciplinary team
- > Carrying out a project in an international context
- > Writing a technical report in English
- > Promoting and communicating scientific and technical results in English

TEACHING STAFF

HEAD OF SPECIALISATION:

Caroline Braud

LECTURERS:

- > Compulsory courses: Thomas Lechevallier, Jean-François Petiot, Matthieu Rauch
- > Fluid Mechanics Track: Sandrine Aubrun, Boris Conan, Vincent Leroy
- > Structures / Materials Track: Laurent Stainier, Bertrand Huneau
- > Automatic Control Track: Mohamed Hamida, Franck Plestan, Guy Lebret

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