

Training Control of wind turbines



EWIS

Being one of the leading institutes on wind energy research, ECN established the EWIS (ECN Wind Industrial Support) group in 2009 to better bring the R&D results to the market. During the last three decades, ECN has developed expertise on aerodynamics, structural analyses, turbine control, offshore operation and maintenance, and grid connection. With the growing wind industry, ECN received more requests for assistance and EWIS has become the vehicle to support the wind energy industry in their product developments.

EWIS's focus is on the high end of the market which means that we will make use of tools and knowledge that have been developed in-house and include the latest R&D results!

The EWIS team is a mixture of young professionals and experienced researchers which ensures a fast response and high quality.

More information

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Description of training

Purpose

The purpose of the course is to teach practitioners to design industrial wind turbine controllers that achieve speed and power regulation, as well as active loads reduction.

Organisation and content

The training is offered as a 5-day course in a standard form, although the possibility exists to adapt the length and/or the focus of the course depending on the specific wishes of the client. The course begins with building basic knowledge on control, and giving an outline of the structure and the different control components that are encountered in typical conventional wind turbine controllers, as used in the industry. This baseline control includes loops that use the generator torque and the blade pitch mechanism to achieve power regulation, rotor speed control, drive-train damping, and feed-forward control of estimated rotor-effective wind speed. Some additional topics that are covered are gain-scheduling, wind speed estimation, and filter design. Specific attention is paid to (passive) loads reduction by peak-shaving and supervisory control settings.

The second part of the course focuses on feedback control for fatigue load reduction on important wind turbine components, such as tower, blades, shaft, etc. More specifically, it will be discussed how tower vibration in the fore-aft direction can be reduced using collective blade pitch control, how the side-to-side tower motion can be actively damped by using control of generator torque, and how individual pitch control can mitigate fatigue loads in the blades and other wind turbine components (shaft, nacelle, yaw bearing, etc).

Some of the discussed control loops are accompanied by interactive examples in the Matlab / Simulink environment. Participants that are specifically interested in acquiring software tools for wind turbine control design can purchase the ECN Control Design Tool, which is offered with a dedicated course.

The contents of the course are provided in more detail on the next page.

Target Group:	Wind turbine control designers, research institutes, universities.
Required educational level of attendees:	Engineers/scientists. Some basic knowledge of systems control is required.
Track record:	This is a new course offered as an alternative to the course for licensees of the ECN Control Design Tool, which has been given for several years.
Minimum/maximum number of participants:	The number of participants is not limited but groups with more than 10 participants require some special arrangements which need to be negotiated.

For more information about this training, please contact:

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Contents

Day 1 Baseline wind turbine control

- Blade pitch control for rotor speed: design, evaluation, filters, gain-scheduling, peak shaving
- Generator torque control for power regulation
- Drive-train damping control
- Wind speed estimation and feed-forward control

Day 2 Controller aspects in relation to specific design load cases

- Basic concepts
- Controller aspects in relation to dynamic response
- Supervisory control aspects

Day 3 Active tower damping control

- Tower fore-aft damping by collective blade pitch control
- Tower side-to-side damping by generator torque control

Days 4-5 Individual pitch control

- Turbine modelling for individual pitch control
- Wind excitation on blades and rotor
- Coleman transformation to non-rotating co-ordinates
- 1p and 2p individual pitch control design and implementation
- Gain scheduling of individual pitch controllers
- Dealing with actuator constraints in individual pitch control.

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