

Control Design Tool (CDT)



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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Product description

The Software

The ECN Control Design Tool (CDT) has been developed for designing wind turbine feedback control algorithms. The software is implemented in MATLAB® / Simulink® and distributed as open source. Due to its automatic code generation abilities it combines high level development with seamless integration with aero-elastic codes and PLC hardware.

The CDT is ideally suited for turbine manufacturers and researchers, who seek to design production quality controllers, develop and test advanced control algorithms, or learn more about wind turbine control.

The Model

The CDT targets horizontal axis, variable speed, active pitch to vane regulated turbines. The controller contains the feedback algorithms for collective pitch and generator actuation. Complementing the design modules, the CDT features frequency domain analysis and time domain evaluation options.

Input

Apart from the turbine and empirical control parameters, the CDT relies on the input of power and thrust (C_p, C_t) coefficient tables. Such tables are usually produced by design software for rotor blades or aero-elastic codes. ECN uses for example the blade design software BOT (Blade Optimisation Tool) and aero-elastic code PHATAS.

Specifications

Description of Software:	<ul style="list-style-type: none">• Design files (.m), Controller files (.mdl), code generation files (.c and others).• Software manual and code generation manual.
Designated sites:	Single site
Licence fee:	€ 25 000
Licence term:	Unlimited use
Additional maintenance fee:	Optional additional maintenance consisting of an update of the software and support for one year with a maximum of 40 man-hours can be requested for € 6 000 per year.
Additional options:	Basic one-week training in wind turbine control engineering and the use of the CDT given by ECN experts for € 10 000. Extension possible to meet customer requirements.

For more information about this service:

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Output

Each design module can present graphical output of its intermediate results. This allows for early inspection and fast design iteration. The frequency domain analysis provides Nyquist diagrams of (ranges of) operating points. In this analysis different controller configurations can be compared. The fast time domain simulation offers an insightful preliminary evaluation of the controller.

The controller model relies on the Simulink Coder® (previously Real-Time Workshop®) for automatic code generation. This allows the controller to be used by aero-elastic codes without any additional coding effort from the user. The output is compatible with commonly used aero-elastic codes (GH Bladed and PHATAS). The generated code can also be used for implementation into a PLC.

The Experience

The CDT has been under active development for many years as an in-house tool. It was made commercially available in 2007. Several licenses have been sold to manufacturers and research centers.

The CDT is also being used by ECN to design controllers for the industry. We have experience with controller certification (IEC editions 2 and 3) using PHATAS. Our controllers are implemented in both Bachmann and Mita-Teknik PLC's.