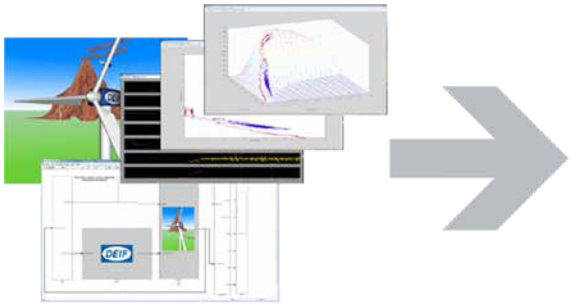
DEIF PLC Link brings new wind turbine control ideas into field operation

10 **years ago, DEIF PLC** Link developed the first support tool for Model Based Design in the wind turbine industry for targeting PLCs; today, the DEIF PLC Link is applied world-wide by e.g. Danish, Chinese, Spanish, and German wind turbine manufacturers. The PLC Link provides transparency in relation to the performance of the wind turbine controller, and is very stable due to the exact code generation, which is performed in just a few minutes. Furthermore, the DEIF PLC Link has been customized in close collaboration with the OEMs Gamesa and Senvion to meet their turbine control requirements and to secure a transparent link code for each turbine. In China, almost 4GW of wind power utilizes the automatic code generation by DEIF's PLC Link.

Translate turbine control strategy with PLC Link and eliminate errors

DEIF PLC Link is a tool for translating wind turbine control strategies modelled in MathWorks® MATLAB®/Simulink® into an IEC61131-compliant code for execution on a wind turbine controller as a standard PLC - such as DEIF's AWC 500 Controller. PLC Link provides a generated code, which is standardized and therefore compatible with a standard PLC. The PLC Link is based on an automated process, which is extremely fast and eliminates the risk of human error; hence, using the PLC Link ensures auto-generated and absolutely flawless code for the turbine control strategy.



PLC Link Features:

- Automatically translates Simulink® models and Stateflow® charts into IEC 61131-3 structured text (ST), ANSI C and Pascal (DELPHI)
- Build stand-alone applications and download directly to your PLC or generate code for implementation into existing PLC projects
- Make you own code integration, test systems, 3rd party system interfacing, code wrapping etc. using the Plugin Interface API allowing custom user interaction with PLC Link.
- Perform software-in-the-loop and PLC-in-the-loop testing
- Monitor your PLC system real-time while using Simulink® scopes for tests
- Tune your PLC system by updating parameters online using Simulink® or MATLAB® command prompts
- Support of 80+ blocks from the standard Simulink® library
- Generate PLC code from embedded MATLAB® blocks
- Include custom IEC 61131-3 PLC code in the code generation process

Code perfection

DEIF's PLC Link plug-in scripts allow software engineers to make post processing of the automatically generated code. This means that the control engineers can feed all the design decisions directly to the parameters lists, link directly to the values in the HMI, or login systems as specified. Normally, this requires a lot of specification work, but with the PLC Link it can be carried out in just a few minutes.

PLC Link customers feel assured knowing that DEIF uses the tool internally for all the important control algorithms in the turbine, for positioning the turbines blades, rotor speed and power; not to mention cluster-based control of entire parks and balancing park power output.

Expert Advice - Using PLC Link for Wind Turbine Control

Control engineer and specialist Brian T. Jensen gives his expert advice on the daily use of PLC Link for wind turbine control strategy development:

What are the challenges working with Model Based Design?

“One of the challenges working with model based design is the ability to easily transition from the design to application code that is used and tested in real life facilities. Model based design typically means that you will end up with more complex and advanced control strategies designed in MATLAB/Simulink in order to improve the performance of your system.

These complex designs can be difficult, or at least very time consuming, to translate into a code that will run on your target. Therefore, in order to fully utilize the benefits of model based design, the process of going from the design to code that can be used and tested in real life applications needs to be easy and fast. PLC Link makes this step very easy and fast by directly transferring the MATLAB/Simulink design into a compiled and ready code within just a few minutes.”

How does PLC Link advance usability?

“Typically, for wind turbine applications, only the more advanced control parts are designed in MATLAB/Simulink, like the turbine power and speed control, yaw control and blade pitch control. The generated code from the MATLAB/Simulink design needs to be adapted into an existing application. For this purpose, the plug-in feature of the PLC Link is very useful and makes it easy to customize the generated code to fit into existing applications with parameter systems, the HMI interface etc. The PLC Link automatically wraps the code representation of the design, meaning there are no manual activities involved when I deploy a new design change.”

Why is PLC Link optimal for commissioning turbines?

“With PLC Link, the commissioning of new wind turbines is easier and faster, because of the flexibility of the design and the opportunities for thoroughly testing the control system in Simulink. By using the generated code from PLC Link, a new prototype wind turbine can be in operation within just a few days. Changes needed on site can easily be made and tested in Simulink; within a few minutes the new code is available to the wind turbine with the PLC Link.”

An example of the model based approach utilizing the PLC Link:

“For example, one of my typical cases concerning commissioning has been to attend the commissioning of a 3 MW prototype turbine.”

“The problem was based on the turbine not performing as expected, and furthermore it also had some difficulties starting up and gaining enough speed on the generator to make grid connection. It turned out that the blades were different from the data I had previously received and used in the modeling and design of the control system.

The solution to the problem was using the correct blade data in the model. I could verify that the model was performing similarly to the real turbine, which gave a clear indication of the real problem. Having updated the control design with the new blade data and verified it in the model, I could subsequently use PLC Link to generate new code, and already the next day the turbine ran completely stable with good performance. Without the model based design approach and PLC Link, such a problem would take several days to identify, solve, and apply the new code.” Brian T. Jensen. ■