

Presentations Alstom Offshore Wind Turbine: Control System

Carlo Enrico Carcangiu is the head of the Control System department. He gave a presentation about the control structure of the new offshore wind turbine of Alstom, Haliade 150 – 6 MW.

The control system has to accomplish the following objectives:

- Integrity and availability. A set of functionalities ensures the operation of the wind turbines: starting and stopping process, yaw control, wind speed and direction monitoring, electrical protections, cooling system, temperature control and heater systems.
- Minimize loads.
- Maximize power production.

The wind turbine control requirements are based on standards and wind turbine technical specifications. The controls are integrated in a hardware layout (Galileo WTC) with Ethernet RT communications. A safety line is integrated in the communication protocol following the standard IEC61508. The software architecture is centralised in a supervisory controller. It includes the operating system, the communications, the safety system, the error management, the HMI and the closed loop controllers. A state machine defines the operational states of the wind turbine. The controller is based on a feedback control of rotor speed and additional load reduction strategies.

The wind turbine operates in 3 zones:

- Optimum Cp. Maximization of power generation for low-speed wind speeds.
- Constant speed. Operation below rated wind speed where the wind turbine reaches the rotor speed limit.
- Constant speed and torque. Operation at nominal power and wind speed. Pitch control is used to limit the power generation to the nominal value.

Alstom has implemented different software tools to manage the wind turbine control:

- Web HMI. Interface that allows the operators to check the errors, adjust parameters and visualize variables.
- ATLAS. Application for maintenance tasks.
- Data logger. It registers all data exchange between master and slave elements.
- SCADA. It has been developed following the IEC 61400-25.

In parallel it is necessary to implement a condition monitoring system that observes the evolution of some variables and apply changes. The condition monitoring is mainly used in mechanical elements: hub bearings, generator and blades. The SCADA is chosen for condition monitoring because is easy to integrate, is modular and allows real time monitoring.