# CONTROL UNIT

WIND TURBINE CLOSED LOOP IDENTIFICATION

- Reducing the gap between theoretical models and real wind turbine.
- Trustful and safe procedure for obtaining control oriented models.
- Avoid rules of thumb for in site controller design.
- Bet for model based controller design.
- Makes possible the robustness design and analysis.
- Faster Wind turbine commisioning.
- New tool for Adaptive and Feedforward control.
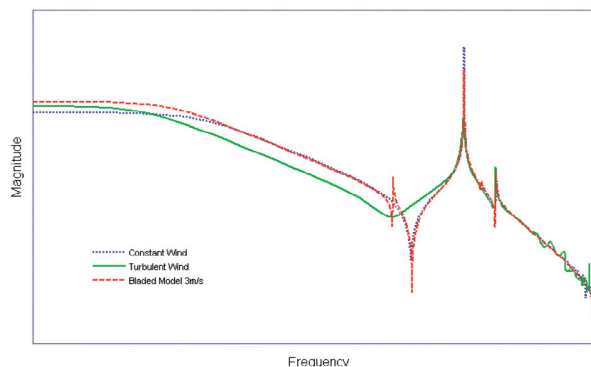
Identified models for constant wind and Turbulent wind, versus linearized modelthe Iberian Peninsula, obtained by the PCA.

CUSTOMIZED CONTROLLER DESIGN FOR FATIGUE AND EXTREME LOAD REDUCTION

- Production controller for load reduction and power maximization.
- Collective pitch controller.
- Individual pitch control.
- Tower damping algorithms.
- Specific strategies for extreme load reduction.
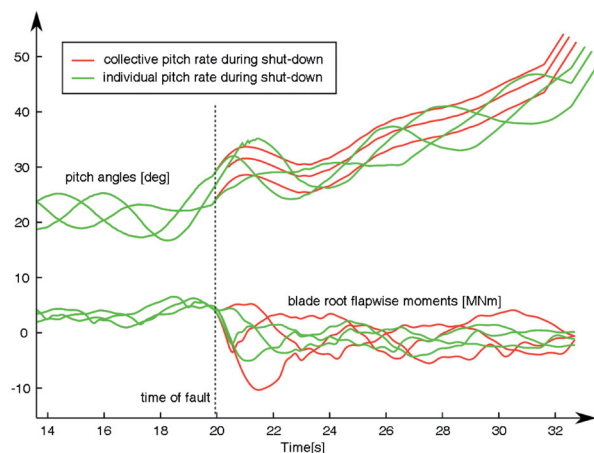
Flapwise moments, with new optimized extreme load reduction strategies.

In order to achieve robust controller, trustful stability limits, load reduction and power optimization, wind turbine controllers design requires the availability of reliable control oriented linear models for model based controller design. Model identification of wind turbine, while operating in closed loop operation, is the most appropriate solution which has recently shown its capabilities for obtaining reliable linear control oriented models, for torque and pitch loop. The use of a controller during the experimental protocol warranties the stability and integrity of the Wind Turbine. No more rules of thumb, or trial and error controllers tuning method, with unknown control performances will be needed. Instead, model based controllers design will be designed for each in site Wind Turbine, onshore and offshore, reducing the commissioning time and increasing the reliability of the controllers and its performances.

No matter the complexity of the control scheme, or the used control loop used in the Wind Turbine: non linear controllers, cascade control, filtering ..., now CENER has developed closed loop identification algorithms for the main control loops of the Wind Turbines: torque loop, pitch loop, tower damping, drive train damping,...
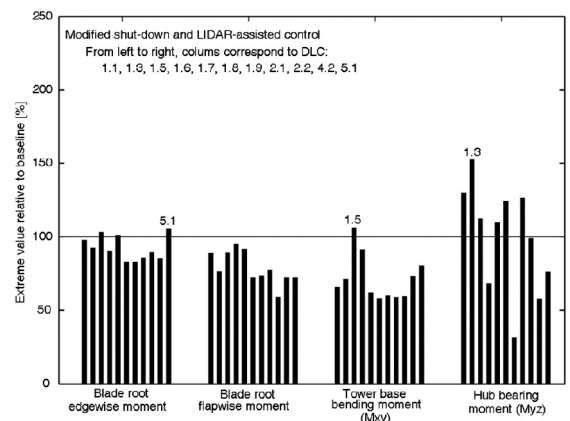
Control developments is a key factor for Wind Turbine design and for energy cost reduction. CENER has developed its own control solution which provides and optimized power production, limiting both fatigue and extreme loads. CENER's own control algorithms for limiting fatigue loads for tower and for blade and hub has been proved. In addition, the latest advances for extreme loads control can reach almost the major loads reduction based on supervisory control and safety control.
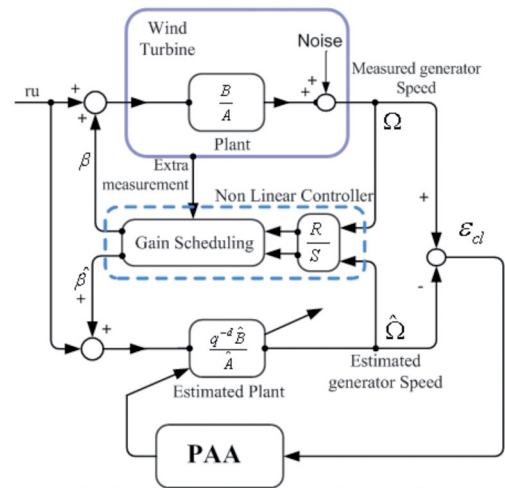
Closed Loop Identification Algorithm for non linear controllers
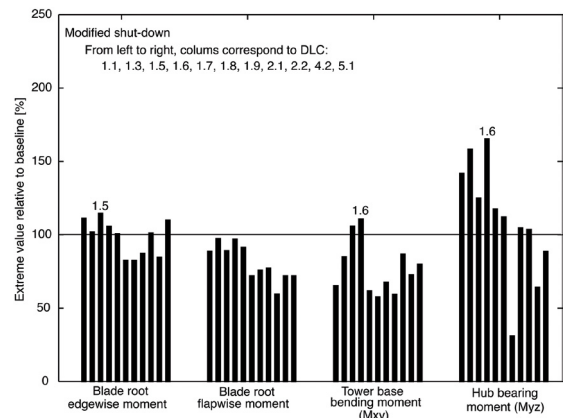
Extreme loads limits analysis with smart supervisory control compared with non control extreme loads

Extreme loads limits analysis with smart supervisory control and LIDAR