

The National Renewable Energy Centre of Spain -CENER- is a technology centre specialized in applied research and development as well as the promotion of renewable energies. CENER is divided into six departments: Wind Energy, Photovoltaic Solar Energy, Solar Thermal Energy, Biomass Energy, Bioclimatic Architecture and Renewable Energy Grid Integration.

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## WIND TURBINE CONTROLLER DESIGN



### CAPABILITIES AND SERVICES

Implementation of fine-tuned efficient control algorithms is a keystone for improving wind turbine performance while reducing mechanical loads on components. Model-based control design is nowadays one of the most useful approaches to achieve high-performance wind turbine controllers. CENER has gathered valuable expertise in this field and currently offers the following services:

#### Design of control algorithms:

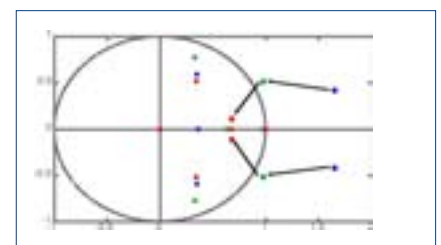
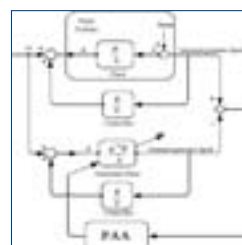
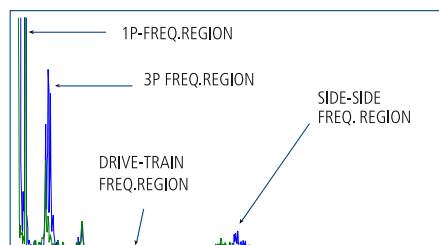
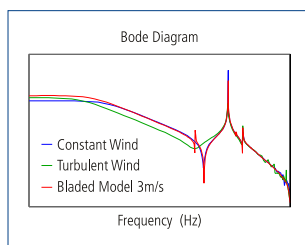
- Torque controllers including drive-train load damping strategies
- Collective pitch controllers
- Individual pitch controllers
- Tower fore-aft and side-side load reduction algorithms

#### Generation of well-conditioned wind turbine linear models for control design:

CENER has developed an innovative approach based on close-loop identification techniques, which yields very reliable wind turbine linear models suitable for control design. Such models can be obtained on the basis of:

- Aeroelastic non-linear complex numerical models
- Prototype field experiments

Developed techniques open up new possibilities for advanced adaptive control approaches.



### RESEARCH

Research topics at CENER within the field of wind turbine control design include:

- Adaptive control
- Hardware-in-the-Loop environments for validation of controllers