

Design of Wind Energy Systems – Summer Semester 2016

CIP-Tutorial 6b: Extreme loads

Both fatigue and extreme loads are used to size specific components (i.e. tower, blades, etc.). In this CIP tutorial you will estimate extreme loads in a couple of load cases.

Tasks to be solved in Tutorial 6b:

1. A wind turbine is designed to withstand certain extreme conditions. Make a list with at least five extreme load cases and describe their characteristics. What is the extreme condition being modelled? Why is it important?

Hint: The standard IEC 61400-1 defines the load cases that should be simulated to assure the integrity of a wind turbine. It includes a table with fatigue and extreme load cases

2. Let's create the wind conditions for the design load cases 1.5 (power production & extreme wind shear – EWS) and 2.3 (power production plus fault & extreme operating gust – EOG).

Hints:

- modify the input file *IEC.ipt* (keep same name) and run *IECwind.exe*, located in the folder "*\FAST\windExtreme*"
- we will only use the wind files for gust (1-year and 50-year return) at rated wind speed „*EOG_01_R.wnd*“, „*EOG_50_R.wnd*“ and extreme wind vertical shear at rated wind speed „*EWSV00_R.wnd*“

3. Simulate with FAST the design load cases 1.5 and 2.3

*Hint: update AeroDyn input file *.ipt and FAST input file *.fst, located in the folder "\FAST" to call the respective wind file and run calculation. Name files differently for each calculation.*

4. Investigate timeseries and discuss qualitatively the results. Does the timing for failures affect the result? What about the torque of the brake?

*Hint: Use the Matlab script *PlotFastTimeseries.m* already included in the folder. In slide 18, input parameters that define start of grid failure (*TimeGenOf*), activation time, nominal torque and time for nominal torque of the brake (*THSSBrDp*, *HSSBrTqF* & *HSSBrDT*) are indicated.*

5. Create an extreme load table from the results, including forces and moments in the blade root and tower bottom. Comment your findings. What is the dominant case?

Hint: an example can be found in "CIP_06b_DoWES.Hints_for_extreme_loads.SS2016.00.pdf"