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1 Introduction and motivation Soni

2 Controller design objectives

2.1 Advanced Controller

Wind turbine use closed-loop control systems to continuously adjust their operations based on feedback. Figure 1, illustrates the advanced control closed-loop diagram of a wind turbine.

The torque controller optimizes power production below rated speed and maintain rated power and maintain rated power above rated wind speed by adjusting generator torque (M_G) based on generator speed (Ω_G). Advance torque control uses a PI controller with anti-windup to regulate the generator torque based on the difference between the actual and reference generator speeds. Above rated wind speed, Pitch controller maintains the rated generator speed $(\Omega_{G,rated})$ by adjusting blade pitch angle (θ), which ensures the rated power is maintained. With increasing wind speed, the pitch angle increases to reduce power coefficient (c_p). Once the wind speed reaches the rated value, the generator torque is maintained at its rated value. The control is categorized into different regions, as detailed in Section 2.2.

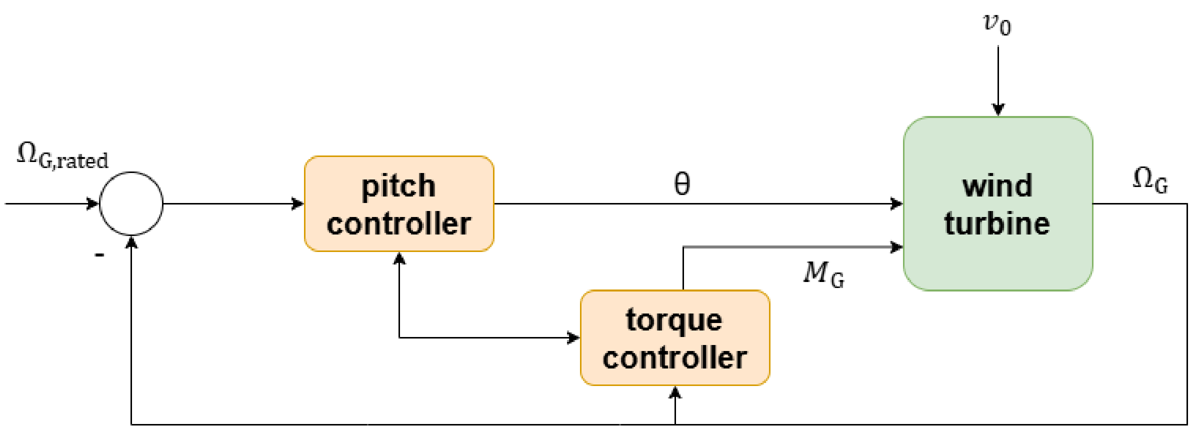

Figure 2.1 Advance Wind Turbine Controller

2.2 Control Region Soni

2.3 Generator Torque controller Soni

2.4 Collective pitch controller CPC Julius

2.5 Tower Damper Felix

3 Further Things

3.1 Windfield Generation Felix

3.2 Storage model with scenario options Julius

3.3 tower stiffness calculation Julius

4 Controller tuning

4.1 steady states

4.2 DEL calculation thetaK Felix

4.3 theta min static Julius

0.5 deg

4.4 theta dynamic Julius

not worth it

5 Challenges and Teamwork

5.1 Generator speed and Region 2.5

5.2 Rated wind speed

5.3 Aerodynamics in FAST

6 Summary

6.1 Conclusion

7 Appendix