

Power output maximization of Wind-Turbines

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INTRODUCTION

Choosing correct strategy to control Horizontal Axis Wind Turbine (HAWT) is crucial in order to produce maximum available power. However, before designing the controller, mathematical model of wind turbine must be formulated. The controller must deal with not only non-linearities in the model description, but also with stochastic influences of the wind, and shifting between control objectives. Stationary analysis of the differential equations together with the physical limitations of the turbine itself yields in four operational regions. The main project idea, is to formulate a universal optimization problem, which ensures maximum power production subject to constraints.

MODEL PREDICTIVE CONTROL

Model predictive control (MPC) has been chosen as a control strategy. MPC has several advantages. The main advantage is, that the algorithm calculates the optimal control action, but still obeys constraints. These constraints are mainly physical limitations of the system e.g. angular velocity of the turbine, or change in the pitch angle. Imposing constraints may also be motivated by safety of operation.

CONCLUSIONS

This project deals with new strategies of controlling the HAWT. Controllers currently implemented, has several drawbacks, mainly they don't account for the constraints. MPC together with Kalman estimator allows us to operate closely to upper physical limitations of the HAWT, without damaging the turbine. Therefore we can produce more power, with same wind turbines.