MEC583 Project on Wind Energy
Report

Application of the Blade Element Momentum Theory

by

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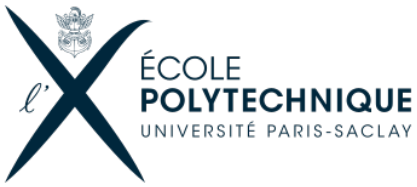

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Abstract

¡Abstract here¿

Contents

Chapter 1

Problem Definition

The objective of this project is to numerically compute, for a given incoming wind and a given turbine, the loads on the blades and the power coefficient. The turbine is characterized by number of blades, blade length, airfoil shape and cord as well as pitch angle. The behaviour of the airfoil is described by empiric curves that describe drag and lift coefficient as function of the angle of attack. The incoming wind is assumed incompressible, uniform and perpendicular to the swept area of the turbine. It is only characterized by the upstream velocity U_0 and the constant density ρ. The turbine is considered in a steady state, with controlled angular velocity Ω. Blade element momentum theory is applied to create a computational model to solve the given problem.

The model is run multiple times while varying a variety of parameters, in order to analyse the sensitivity of the wind turbine power output to changes in these parameters. No optimization algorithm is proposed.

The parameters of the problem with their respective unit of measurement are defined in the following table:

R	m	Blade length
Ω	rad/s	Turbine angular velocity
N	-	Number of blades
rho	kg/m^3	Air density
U_0	m/s	Incoming wind speed
c	m	Airfoil cord
c_l	-	Lift coefficient
c_d	-	Drag coefficient
a	-	Induction factor
a'	-	Angular induction factor
α	rad	Angle of attack
β	rad	Pitch angle
ϕ	rad	Relative angle of incoming wind

Chapter 2

Introduction

2.1 Background and Recent Research

2.1.1 ¡any sub section here¿

2.1.2 Literature Survey

¡Sub-subsection title¿

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¡Sub-subsection title¿

even more text[1], and even more.

2.2 Motivation

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Chapter 3

Work Done

3.1 ¡Section title¿

3.1.1 ¡Sub-section title¿

3.1.2 ¡Sub-section title¿

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3.1.3 ¡Sub-section title¿

3.1.4 ¡Sub-section title¿

Refer figure 3.1.

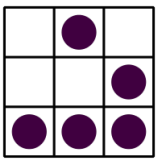

Figure 3.1: ¡Caption here¿

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3.2 ¡Section title¿

Chapter 4

Future Work

¡Future work here¿

Chapter 5

Conclusion

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Acknowledgments

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References

[1] ¡Name of the reference here¿, `<urlhere>`

[2] ¡Name of the reference here¿, `<urlhere>`