

كلية الهندسة

قسم هندسة القوى الميكانيكية

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عنوان الرسالة : دراسة تأثير الهواء علي ريشة تربينة هوائية متصلة بالشبكة في  
نطاقها المرن

اسم الدرجة : ماجستير العلوم الهندسية في الهندسة الميكانيكية (شعبة قوى ميكانيكية)

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تاريخ البحث : ٢٠١٥/١٢/١٦

الدراسات العليا:

ختم الإجازة: اجيزت الرسالة بتاريخ: ...../...../.....

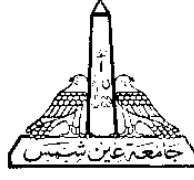
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القاهرة- (2015)



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الموافقة على المنح

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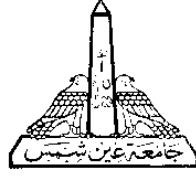
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# دراسة تأثير الهواء علي ريشة تربينة هوائية متصلة بالشبكة في نطاقها المرن

رسالة مقدمة للحصول على درجة ماجستير العلوم الهندسية في

هندسة القوى الميكانيكية

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حاصل على بكالوريوس العلوم

هندسة القوى الميكانيكية

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## Statement

This thesis is submitted in partial fulfilment of the Master of Science in Mechanical Engineering, Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Date: 26 December 2015

An Aero-Elastic Study of a Utility Scale Wind Turbine

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An Aero-Elastic Study of a Utility Scale Wind Turbine

## Thesis Summary

This work aims to optimize the aerodynamic and structural design of the 5MW *NREL* wind turbine and a site specific derivative minimizing the levelized cost of energy, *LCOE*, generated from these two wind turbine designs.

The first step was the design of a site specific wind turbine. This design was achieved by replacing the primary and tip sections' airfoil profiles with *NREL S*-family airfoils for its low sensitivity to surface contamination. The second step was optimization of these two wind turbine designs to Zaafarana site wind conditions. This optimization was carried out using a genetic algorithm developed in *MATLAB* coupled with *FAST* modularization framework.

This approach resulted in decreasing the *LCOE* of the baseline 5MW *NREL* wind turbine by 2.7% due to using airfoil with low-sensitivity to dust contamination and the optimization of the designs to site-specific wind conditions.

**Keywords:** wind turbine, optimization, levelized cost of energy, genetic algorithm, surface contamination, site-specific design.

## **Acknowledgment**

In the beginning, I want to thank Allah Almighty for his grace that allowed me to complete this work in this form.

Also I want to thank my family for their great support during the preparation of this research and this work.

Also I want to thank my supervisor Prof. Dr. Zakaria Ghoniem for his experience, vision, ideas and contribution in this work.

In the end, I would like to thank my supervisor Dr. Aya Diab for her effort, dedication and bright ideas that were the main reasons that made this work possible.

**January 2016**

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