# بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

# شبكة المعلومات الجامعية
# التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

***MONA MAGHRABY***

# AERODYNAMIC DESIGN OPTIMIZATION OF SMALL WIND TURBINE BLADES

By

**Karim Sayed Abdelwahed Ahmed**

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
**MASTER OF SCIENCE**
in
**Mechanical Power Engineering**

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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**Title of Thesis:**

Aerodynamic Design Optimization of Small Wind Turbine Blades

**Key Words:**
Airfoil Optimization; Wind Turbines; Genetic Algorithm; XFOIL; CFD

**Summary:**

A particular shape optimization study of the standard SG6043 airfoil that applies the genetic algorithm is reported to find the maximum lift-to-drag ratio. The operating angle of attack is considered as an optimization parameter in four scenarios. This is followed by a CFD analysis using $\gamma - Re_\theta$ SST $k - \omega$ transition model to further validate the numerical model in addition to experimental work. An optimum rotor design is then implemented using the optimized airfoils to evaluate the impact of the improved lift-to-drag ratio on the power coefficient and annual energy production of small wind turbines.

# Disclaimer

I hereby declare that this thesis is my own original work and has not been submitted before to any institution for assessment purposes. I have acknowledged all sources used and have cited these in the reference section.

Name: Karim Sayed Abdelwahed Ahmed Date: 28 / 10 / 2021

Signature:

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