



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكروفيلم

# بسم الله الرحمن الرحيم



**MONA MAGHRABY**



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# شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

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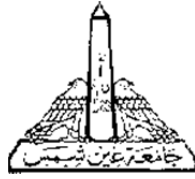


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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



**MONA MAGHRABY**



AIN SHAMS UNIVERSITY  
FACULTY OF ENGINEERING

**A Design for Increasing Power Using a Solar Tower  
Unit**

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS OF THE MASTER DEGREE IN  
MECHANICAL POWER  
ENGINEERING

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Cairo, Egypt

(2019)

## EXAMINERS' COMMITTEE

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“A Design for Increasing Power Using a Solar Tower Unit”, submitted by Eng. Mohamed Awry Mahmoud Abd El Hafez, in partial fulfillment of the requirements of the degree of Masters of Science in Mechanical Engineering

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## **Statement**

This thesis is submitted as a partial fulfillment of Master degree of Mechanical Power 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.

**Mohamed Awry Mahmoud Abd El Hafez**

**Date: 2019**

*To:*

*My*

*Mother*

*My*

*Father*

*My*

*Brothers*

*My wife*

*My Sons*

## Acknowledgment

First and most, praise and thanks to Almighty ALLAH, the most Gracious and Merciful.

I would like to express my huge enormous thanks and appreciation to my family, my mother who was and still always there with me pushing me forward and supporting me at the most critical moments, my wife who really participated in what i achieved in my life, my kids who give me hope and ambitious in the future, my brothers who are always my great support in life.

I can't forget also my work Collegiums and great friends (Ahmed Khalid, Basel Abd Mageed, Ahmed Osman, Waleed Eliwa, Waheed Wagdy and Basem Abd El Samee) whom all supported me in the practical side of the research.

I would like to start by expressing my gratefulness to my advisor **Prof.Dr. Mohamed Aboel-Enin El-Samanoudy** for his guidance, teaching and mentorship throughout my Master degree work. He is always there with insights, patience and support.

Then I would like to express special thanks gratefulness and expressive enormous appreciation to my advisor Dr. **Hamdy Abo Taleb**, Dr. Hamdy, I cannot thank you enough, you were always an extremely rigid support.

Finally, I would like to express my great gratitude to the soul of my Father; he had a great influence on my whole personality and he had a great role in raising me up. In addition to, his prayers for me, which supported me all of my life, may Allah be merciful to him inshallah.



## Abstract

With the growing demand on electrical power for day to day activities that coincides with less power resources specially for fossil fuels that is also creating many issues for the environment, a big need for shifting round to the Renewable energy resources(e.g. solar , wind , water , sea waves ,...,etc.,)which is more cheaper and effectively clean.

One of the most common renewable energy types is the solar energy with different power generation ways (photovoltaic solar system, thermal solar system).

Many studies were there for enhancing the use of thermal solar system technology that converts radiation from sun into heat energy that would be useful for energy generation through many ways and techniques. One of the newly developed technologies for the thermal solar energy is the solar chimney which is the subject of our study in this research.

Conventional solar chimney theory based on retaining long waves Sun radiation and admits short waves solar radiation through a transparent surface (collector) thus solar radiation is absorbed heating up air that will start raising up inside the chimney where located turbine(s) with electrical generator would start producing electrical power.

In this work, power generation enhancement for a 2.00 m height hexagonal base solar chimney with a 6 double faced trapezium sides is introduced. Amount of energy acquired to move the generating part of the solar tower (direct current fan on the exit) depends on the air flow which will increase with the temperature raise that is affected by the solar heat up of the double faced sides. Analysis and comparison will be based on taking different temperature readings in 3 cases for the stagnant fluid filling the gap of the double faced solar tower sides (air, vacuum and helium) to see the best case where the highest air temperature is reached and consequently having the highest generated power.

In addition to that, a Savonius air turbine is to be fitted on the top of the tower to get more power from the unit in dark time using the wind energy which is a continuous source not relying on solar energy.

Vacuum was found to be the best option due to its lowest heat losses to the surrounding as it acts as heat transfer isolator for conduction, also Savonius was a good addition to the system but with the constrain of having it attached to the system due to induced vibrations and stresses on the solar chimney tower.

**Key words:** *Solar Chimney, Thermocouple, Savonius wind turbine, Ambient temperature, Air flow, Stagnant air, Stagnant helium, Vacuum, Double wallwindow, wind speed.*

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