Dual-Axis Tracking System - Concentrating Collectors

Bachelor Thesis

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This is to certify that:

(i) the thesis comprises only my original work toward the Bachelor Degree

(ii) due acknowledgement has been made in the text to all other material used

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Ahmed El Araby
09 February, 2022

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IV

Acknowledgments

First and foremost I am thankful to ALLAH for giving me the strength, knowledge and opportunity to undertake this study and complete it satisfactorily.

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Abstract

This is an experimental study that examines the effect of using continuous two-axis sun tracking algorithm for parabolic dish collectors. Experiments on the performance of the dual-axis tracking were conducted and compared to alternative techniques like fixed surface and one dimensional tracking. This system uses a simple economical electro-mechanical system which consists of sensors, motors and a microcontroller. This low-maintenance operation that calculates the azimuth and elevation angles indicated to have rewarding results. This tracking system is applicable to most solar collectors and panels.

Contents

Chapter 1

Introduction

1.1 Background

There's no denying the importance of solar energy. The return on investment of going solar is highly valuable, and not just financially, but for the sake of public health and environmental sustainability. One of the solar energy systems used are solar collectors which are used in this paper to demonstrate our solar tracking system and algorithm.

The Sun travels across the sky from the time it rises until the time it sets.The sun path across the day is an essential factor as the position of the sun must be precisely normal to the solar collector's focal point, hence, increasing the collector's overall heat gain. This can be achieved by the use of a solar tracking system that can ensure that maximum energy is constantly and persistently harvested by accurately orienting the solar collector towards the Sun.

Sunlight is composed of two constituents; direct beam and diffuse sunlight. Ninety percent of the solar energy is conveyed by direct beam radiation while the remaining portion is conveyed by diffuse sunlight [2]. Non-concentrating solar collectors accept both direct and diffuse light. However, concentrating solar collectors only accept the direct beam portion since the energy produced is directly proportional to the reflected direct beam radiation that successfully hits its focal line/point. This makes the

solar tracking system more essential in concentrating solar plants because unless directly pointed at the Sun they produce a negligible amount of energy.

There are multiple types of concentrating solar collectors, which are:

1. Parabolic trough collector

2. Power tower receiver

3. Parabolic dish collector

4. Fresnel lens collector

The one used in this thesis is the Parabolic Dish collector, the reason will be elaborated further in section 1.2

1.2   Related Work

There's a wide variety of concentrating collectors in the current market for heat generation, there are mainly two reasons for the use of Parabolic dish collector over the other concentrating collectors, the main reason is that the parabolic dish collector's body which is the dish part of the whole machine can be replaced with flat plate collectors, photo-voltaics or even Solar panels. The other main reason is that parabolic dish collectors or as mentioned in this paper

1.3   Motivation

Some sample text with an Acronym Without Citation (AC), some citation [1], and some more Acronym With Citation [2] (AC2).

Chapter 2

Methodology

2.1   Working Principle

Chapter 3

Conclusion

3.1 Discussion

Some sample text with an AC, some citation [1], and some more AC2.

3.2 Future Work

Reference to Section 3.1, and reuse of AC nad AC2 with also full use of Acronym With Citation [2] (AC2).

Appendix

Appendix A

Lists

AC   Acronym Without Citation

AC2   Acronym With Citation [2]

List of Figures

Bibliography

[1] W.G. Campbell. *Form and style in thesis writing.* Houghton Mifflin, 1954.

[2] S. Wenkang. An analysis of the current state of English majors' BA thesis writing [J]. *Foreign Language World*, 3, 2004.