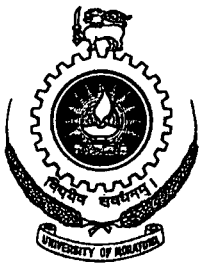


OPERATION OF TWO-AXIS SOLAR TRACKING BY THE DISCHARGE OF WATER FROM A TANK HANGING BY A NON-CIRCULAR SPROCKET WHEEL

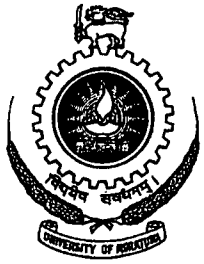
Master of Engineering in Manufacturing Systems Engineering

by

M. H. S. INDIKA

Department of Mechanical Engineering
University of Moratuwa, Sri Lanka

August 2009



OPERATION OF TWO-AXIS SOLAR TRACKING BY THE DISCHARGE OF WATER FROM A TANK HANGING BY A NON-CIRCULAR SPROCKET WHEEL

A dissertation submitted to the Department of Mechanical Engineering, University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Engineering in Manufacturing Systems Engineering

by

MAWANANA HETTIGE SAMANTHA INDIKA

Supervised By: Dr. G. K. Watugala & Dr. W. K. Wimalasiri
Universith of Moratuwa

Department of Mechanical Engineering
University of Moratuwa, Sri Lanka

August 2009

DECLARATION

This Dissertation paper contains no material which has been accepted for the award of any other degree or diploma in any University or equivalent institution in Sri Lanka or abroad, and that to the best of my knowledge and belief, contains no material previously published or written by any other person, except where due reference is made in the text of this Dissertation.

I carried out the work described in this Dissertation under the supervision of Dr. G. K. Watugala & Dr. W. K. Wimalasiri.

Signature : *UOM Verified Signature* Date : 01/07/2010

Name of Student : M. H. S. Indika

Registration No : 05/8644

I endorse the declaration by the candidate.

Signature *UOM Verified Signature* Date : 01/07/2010

Name of Supervisor : Dr. W. K. Wimalasiri

Abstract

Two-axis solar tracking system operated by the discharge of water from a bottom hole of a tank filled with water was designed, constructed and tested. The water tank is hanged by a chain passing over a non-circular sprocket wheel which is fixed to the rotating shaft along the first solar tracking axis. A counterweight is also hanged by another chain passing over a regular circular sprocket. In the morning, the tank is full and the water tank and the counterweight on either side of the shaft balance in such a way that the solar panel is facing the East as required. This study shows that the contour of the non-circular sprocket wheel can be designed taking into consideration the reduction of weight of water tank with time and the required rotation for solar tracking. In addition to the hourly tracking by the above mechanism, provision has been made to tilt the second tracking axis of the solar panel manually on a weekly basis to compensate for the seasonal variation of the Sun's declination.

Results show that the additional cost involved in making this mechanism is justifiable when considering the increase of about 30% of more solar power obtainable by two-axis tracking.

The paper published regarding this tracking system at Sri Lanka Association for the Advancement of Science (SLAAS) in 64th Annual Sessions held on 01-06 December 2008 shown in Appendix A.

Acknowledgements

It is greatest respect and indebtedness to the my first supervisor Late Dr G. K. Watugala, for his great insights, perspectives, guidance and sense of humour. Also It is greatest respect and indebtedness to the my second supervisor Dr W. K. Wimalasiri, Senior Lecturer of the Department of mechanical Engineering for his great insights, perspectives, guidance and sense of humour. My sincere thanks go to the officers in Post Graduate Office, Faculty of Engineering, University of Moratuwa, Sri Lanka for helping in various ways to clarify the things related to my academic works in time with excellent cooperation and guidance. Sincere gratitude is also extended to the people who serve in the Department of mechanical Engineering office.

Lastly, I should thank many individuals, friends and colleagues who have not been mentioned here personally in making this educational process a success. May be I could not have made it without your supports.

List of Contents

List of Figures

List of Tables