Design and Application of a Solar Orientation Measurement System

黃文震、李佳言

E-mail: 9511326@mail.dyu.edu.tw

ABSTRACT

This paper presents a novel solar orientation measurement system based on solar cells. A methodology for calculating the solar orientation is developed in which the time and latitude angles of the sun are determined from the measured output voltages of inclined solar cells. Three types of measurement system are considered, namely a single cell type, a double cell type, and a quadrantal cell type. The relationship between the measured output voltages of the solar cells and the solar position is fully explored and documented for each measurement system. In the quadrantal measurement system, a variation in the time angle or latitude angle of the sun generates a corresponding change in the comparative output voltages of the East/West (E/W) or South/North (S/N) solar cells, respectively. By inclining the solar cells at an angle of 45 degrees, it is found that the comparative voltage ratio is sufficiently large that the time and latitude angles can be accurately predicted. The proposed measurement system provides a valuable contribution to the ongoing development of tracking systems in the solar energy technology field.

Keywords : Solar cell, Solar orientation, Solar collector

Table of Contents

REFERENCES

[1] Blanco.Muriel, M., Alarcon.Padilla, D.C., Lopez.Moratalla, T., Lara.Coira, M., Computing the Solar Vector, Solar Energy 70 , 431.441, 2001.

[2] Algifri, A. H., Al.towaie, H. A., Efficient Orientation Impacts of Box.type Solar Cooker on the Cooker Performance, Solar Energy 70, 165.170, 2001.

[3] Berenguel, M., Rubio, F.R., Valverde, A., Lara, P. J., Arahal, M. R., Camacho, E. F., Lopez, M., An artificial vision.based control system for automatic heliostat positioning offset correction in a central receiver solar power plant, Solar Energy 76, 563.575, 2004.

[4] Hj Mohd Yakup, M. A., Malik, A. Q., Optimum tilt angle and orientation for solar collector in Brunei Darussalam, Renewable Energy 24,

223.234, 2001.
[5] Kowalski, S., Solar Powered Light Fixture, enewable Energy 11, 399, 1997.
[6] Surman, R. L., Solar Powered Illuminated Address Number Device and Mailbox Structure, Solar Energy 57, VIII, 1996.
[7] Raasakka, B., Solar Skylight Apparatus, Renewable Energy 12, 117, 1997.
[8] Bari, S., Optimum Slope Angle and Orientation of Solar Collectors for Different Periods of Possible Utilization, Energy Conversion & Management 41, 855.860, 2000.
[9] Tesfamichael, T., Wackelgard E., Angular Solar Absorptance and Incident Angle Modifier of Selective Absorbers for Solar Thermal Collectors, Solar Energy 68, 335.341, 2000.
[10] Popat Pradeep, P., Autonomous, Low.cost, Automatic Window Covering System for Daylighting Applications, Renewable Energy 13, 146, 1998.
[11] Wen, J., Smith, T. F., Absorption of Solar Energy in a Room, Solar Energy 72, 283.297, 2002.
[12] Falbel, G., Puig.Suari, J., Peczalski, A., Sun Oriented and Powered, 3 Axis and Spin Stabilized Cubesats, IEEE Aerospace Conference Proceedings 1, 9.16, 2002.
[13] Chen, Y. M., Wu, H. C., Determination of the Solar Cell Panel Installation Angle, Power Electronics and Drive Systems Proceedings 2, 549.554, 2001.