Theorethical efficiency of a gear based azimuthal tracked photovoltaic platform

B. Butuc[1], G. Moldovean[1] and N. Creanga[1]

[1] Department of Renewable Energy Systems and Recycling
Transilvania University of Brasov
Eroilor 29, 500036, Brasov, Romania,
Phone/Fax number:+40 268 412088, fax +40 268 410525 e-mail: bianca.butuc@unitbv.ro , ghmoldovean@unitbv.ro, nora.creanga@unitbv.ro

Abstract. The paper presents the results of a theoretical analysis developed to estimate the energy produced by an azimuthal tracked photovoltaic (PV) system. The mechanical structure of the tracking system is build up by a worm gear serial connected to a double straight bevel gear. Sun tracking is attained through the sun's trajectories tracking method.

There are presented, simulated and comparatively analysed 5 series of tracking programs, characterized by different numbers of annual intervals and of the step performing intervals. The analysis is made in the hypothesis of clear sky for Braşov – Romania geographical coordinates: 45.65°N latitude, 25.58°E longitude.

The conclusions can be directly used in the implementation stage of the optimum tracking program, to experimentally verify the energetic response theoretically estimated.

Key words

Azimuthal tracking system, tracking discreet program, tracking efficiency

1. Introduction

The energy received by the earth's surface can substitute the amount of the energy obtained from fossil fuels [1]. Therefore, the photovoltaic conversion systems are widely used in various applications.

A main factor influencing the efficiency of the PV conversion systems is the solar radiation rate of use. So, azimuthal tracking systems are a viable technical solution often used to maximize the amount of solar radiation falling on the PV surface [2, 3].

A proper design of the tracked PV conversion systems requires evaluating the energetic performances considering the infield conditions of the implementation site.

The main objective of this paper is to estimate the energetic efficiency of an azimuthal tracked PV system build up of a worm gear –T1 serial connected with a double straight bevel gear –T2. The proposed tracking system, described in [4] and presented in Figure 1, is the subject of a patent request registered at OSIM Bucureşti, Romania with the number A/740/21.09.09.

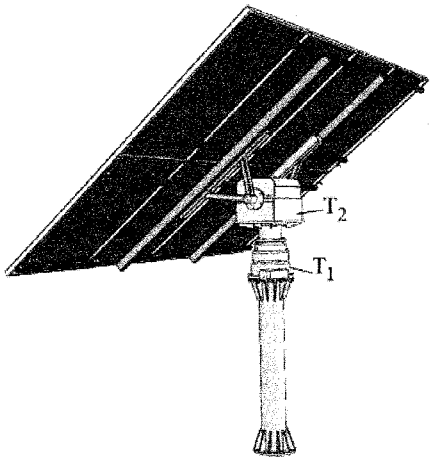

Fig. 1. Gear based azimuthal tracked PV system

A PV tracking system is considered to be energy efficient when the following relation [5] is satisfied:

$$\varepsilon = (E_T - E_F) - E_c >> 0 \qquad (1)$$

where E_T is the energy produced by the tracked PV surface, E_F is the energy produced by the same surface without being tracked and E_C is the energy consumed to perform the tracking movements. E_T is determined considered as input data the tracking method, respectively the tracking programs.