Geared Linkage driven by Linear Actuator used for PV Platform Azimuth Orientation

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Abstract. *To gain more solar energy the photovoltaic converter must be tracked relatively to the sun movement. The majority of the tracking systems use complicated and costly rotating mechanisms to build large angular strokes. This paper presents a new type of geared linkage composed of a triangular linkage fitted with a planetary gear pair able to reach high angular strokes. This linkage is used as basic mechanism for the azimuth tracking of a photovoltaic platform. The kinematic synthesis of the linkage shows that the azimuth angular stroke increases with the planetary gear internal ratio $|i_0|$. The linkage is further implemented for an azimuth mono-axial tracked PV module located in a mountain location (case study - Brasov, Romania). Through numerical simulations, the amount of direct solar radiation on the PV module and the tracking efficiency are evaluated.*

Key words

Photovoltaic module, azimuth tracking system, geared linkage, large angular strokes, tracking efficiency.

1. Introduction

Due to the alarming increase in CO2 emissions, the major cause of global warming, the use of renewable energy sources has become a must. Photovoltaic systems represent a successful path, providing green energy by using the (direct) solar radiation, [1]. To improve their efficiency, tracking systems are imposed. These have the role of following the sun path throughout the day, thus increasing the amount of direct radiation that falls normal on the PV module surface [2].

The tracking systems designed nowadays mainly use rotating actuators to accomplish large angular strokes [3]. The disadvantage of such systems is their high complexity and their cost. An alternative to this system is the linear actuator solution, having the drawback of small transmission angles, thus small angular strokes.

One existing solution is a two-contour linkage [4] in which a four bars mechanism of 4*R* type (*R* = revolute joint) performs high angular strokes (approximately 180°) due to the amplification delivered by a linear actuator.

Our research focuses on the development of a new azimuth tracking mechanism (Figure 1) which performs larger angular strokes on a better transmission angle. The main objective is to increase the amount of direct solar radiation perpendicularly falling on the photovoltaic surface, by using this type of mechanism.

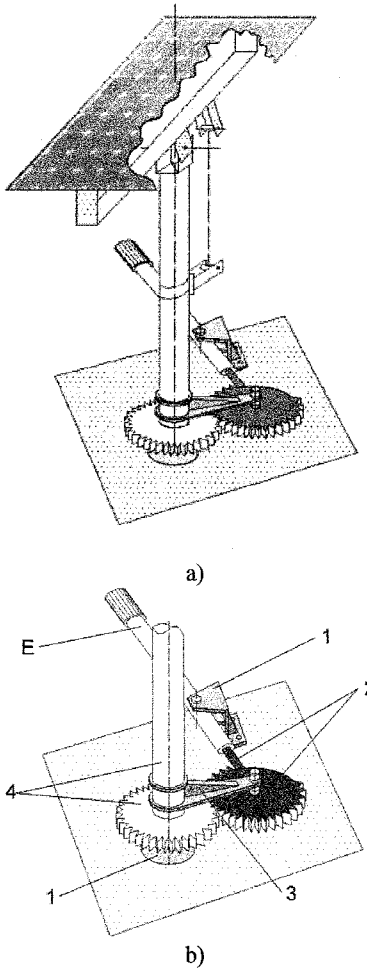

Fig. 1. a) PV system with tracking geared linkage b) geared linkage components.