Wind and weight induced loads on a gear based azimuthal photovoltaic platform

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Abstract. Due to their specific constructive characteristics, such as high surfaces exposed to wind action, the height above the horizontal level and the orientation to wind flow direction, the photovoltaic (PV) platforms are subjected to high mechanical forces. Therefore, wind and weight induced loads analyses is necessary to an optimum design of these systems.

Considering different wind and weight loading cases were determined the equations of forces and torques on each axis of the system (*x*, *y* and *z*). Also, the maximum possible load was established, based on the analyses of the forces and torques daily variations.

Key words

Wind loads, azimuthal PV system, functional angles.

1. Introduction

The objective of this paper is to present the methodology used to determine the wind and weight load on a gear based azimuthal photovoltaic (PV) platform.

The overall size of the structure and transmission of the tracking system are directly depending on the loads of the PV platform. Of all the loads coming from weight, wind and snow, the main load is caused by the wind action [1].

Due to their specific constructive characteristics, such as high surfaces exposed to wind action, the height above the horizontal level and the orientation to wind flow direction, the PV platforms are subjected to high mechanical forces. Therefore, the results of this loads analyses are used as an input parameters for the design of the azimuthal PV platforms.

Considering different wind and weight loads cases were determined the equations of forces and torques on the axes of the system (*x*, *y* and *z*); were simulated the forces and torques daily variations in order to establish the maximum possible load.

2. Tracking system and simulation assumptions description

The tracking system presented in Figure 1 is a simplified constructive version of the solution subjected to a patent proposal [2]. The components of the structural scheme presented in Figure 1 are: the worm gear 1-2, the clutches C1 and C2, the double bevel gear 3-4 and 3-5, the housing 6 and the photovoltaic platform 7. The two clutches operate as normally engaged brakes spring applied and electromagnetically released.

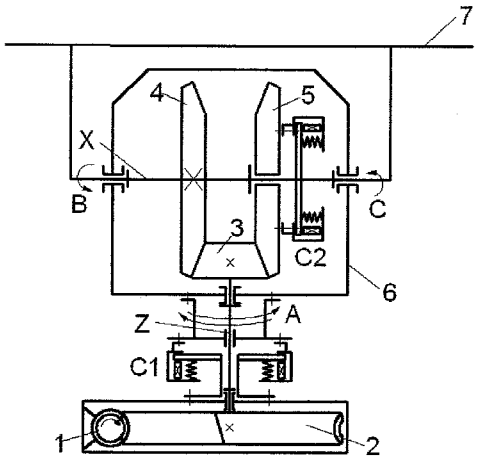

Fig.1. Azimuthal tracking system. Structural scheme

While C2 clutch is engaged and C1 disengaged, the two bevel wheels 4 and 5 – together with the shaft of *x* axis, housing 6 and the PV platform 7 acts like a unit block that will be rotated around z axis. Thus, the specific azimuthal rotational ψ^* movement is performed.

The altitudinal rotational movement α^* performed around *x* axis is achieved by disengaging C2 and engaging C1. By changing the direction of motor drive rotation the altitudinal movement can be performed in both ways: from sunrise to noon and then from noon to sunset. In the