Structural and motion system dynamic analysis of a two-axes solar tracker under wind action

Ana María Gil*, Alberto Acín*, Fernando Rueda* and Ignacio Mayor.**

* Advanced Design & Analysis Division, IDOM (www.idom.es)
** Index Servicios de Ingeniería, grupo Aciturri Aeronáutica (www.indexing.es)

Abstract: Solar trackers are being increasingly used within the industry in order to improve the amount of power produced by photovoltaic systems. The design of these devices must pay special attention to wind action as the most relevant load seen by the generally flexible structure supporting the panels. However, standard building codes may not be particularly suitable for this sort of very flexible, extremely wind-exposed and not very critical-from-a-safety-point-of-view structures.

In this context, a sensible approach in order to estimate the aerodynamic loading acting on the system, has been carried out by a coupling of CFD and structural analyses performed with FLUENT and Abaqus/Standard, respectively. Some relevant aspects such as most critical scenario selection, influence of incoming turbulence in the dynamic response of the structure, and sizing of the motion system (two axes of rotation) in order to overcome the aerodynamic loading during positioning of the tracker, were addressed.

Keywords: Wind loading, turbulence, aerodynamics, structural dynamics, random response analysis, solar tracker.

1. Introduction

1.1 Overall description of the solar tracker

The IN0627 solar tracker is a dual axis device intended to be continuously actuated so that the sunbeam angle remains always normal to the photovoltaic panels orientation. By tracking the sun, the efficiency of the solar panels can be increased by 30-40% with respect to fixed support designs.

The motion of the structure supporting the panels is provided by two rotations, the first one around a vertical axis, usually called azimuth, and the second one around a horizontal axis, usually called elevation. These two rotations are shown in Figure 1.

The azimuth motion is provided by means of a geared motor which transfers the rotation to the upper part of the device through a gearing system, depicted schematically in Figure 2. The elevation motion is provided by a set of two hydraulic actuators, as shown in Figure 3.