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Simulation and optimization of a dual-axis solar tracking mechanism

The work deals with the simulation and optimization of a tracking mechanism used to increase the efficiency of photovoltaic (PV) systems. The proposed solar tracker is one with two degrees of freedom (so called dual-axis, or bi-axial), of the equatorial/polar type. The actuation of the tracking system is carried out with two linear actuators, one for each of the two movements. The study is carried out using a virtual prototyping platform that integrates, into a mechatronic concept, the commercial software packages ADAMS and EASY5. The optimization process is approached from three points of view, which target the mechanical device, the control system, and the bi-axial tracking program. All these optimization processes positively influence, in a specific way, the energy efficiency of the tracking system, which was comprehensively evaluated considering the data specific to the longest light-day of the year (i.e. summer solstice), where a net energy gain of 58.66% (by reference to the equivalent fixed system) was obtained. Similar numerical simulations corresponding to several representative days of the year have revealed that the annual net energy gain is around 42%, which fully justifies the use of the proposed tracking system.

Keywords: dual-axis tracking system, energy gain, simulation, optimization,

Biography

Dr. Cătălin Alexandru is a full professor of Transilvania University of Brașov, Faculty of Product Design and Environment. He is currently the Director of Council for Doctoral Studies. His main research interests are linked to renewable energy systems (with special emphasis in solar energy), mechanical & mechatronic systems' design and testing, virtual prototyping: modeling, simulation and optimization. He published 11 books, 10 chapters in various books, and more than 250 scientific papers in journals and conference proceedings. Prof. Alexandru is a PhD Supervisor in Mechanical Engineering.

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