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Timisoara, Romania
October 06 - 08, 2011

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MECHANISMS AND MACHINE SCIENCE

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# Mechanisms, Transmissions and Applications

Springer

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# Differential Planetary Gear Transmissions Usable in Renewable Energy Systems

**R. Saulescu, C. Jaliu, D. Ciobanu, and D. Diaconescu**

**Abstract** Many of the renewable energy systems (RES) use planetary gears for the speed increase or reduction. The paper presents a 2 DOF planetary gear transmission to be used as "speed increaser" in the counter-rotating wind turbines, hydropower plants, and, also as "speed reducer", in the tracking systems that equip the solar photovoltaic or solar thermal systems. The transmission modelling, simulation and examples of applications in the field of renewable energy systems is presented in the paper.

**Keywords** Renewable energy system (RES) · Planetary gear · Counter-rotating

## 1 Introduction

Increased fossil fuel prices, reduced fossil fuel stocks and concern for specialists to minimize emissions of greenhouse effect gas have led to increased interest for using renewable energy sources. The main renewable energy source is the sun. The direct conversion of solar radiation into electricity can be done by using photovoltaic panels [2]. Thermal energy can be obtained from solar radiation by using solar collectors. Using the indirect conversion, solar radiation can be transformed into electricity be means of wind turbines or hydropower plants [1,9,16,17]. In case of solar collectors or photovoltaic panels, because of the sun position change on the sky, these systems use tracking mechanisms to increase the amount of solar radiation. Tracking systems are classified by their motions: rotation around one axis or around two axes; they are composed of linkages or gear mechanisms driven by linear actuators or gear-motor.

In case of wind turbines and hydropower plants, a gearbox can be used to transmit motion from rotor / turbine to generator [6,7,8,10,11,12,13]. Three basic types of gearboxes are used: belt transmissions [9], parallel-shaft gears [15,17] and 1 DOF planetary gears [1,6]. In the first two cases, the dimensions and cost increase

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