*Renewable Energy and Power Quality Journal* (RE&PQJ), ISSN 2172-038 X, No.9, 12th May 2011, Reference Paper: 540

European Association for the Development of Renewable Energies, Environment and Power Quality (EA4EPQ)

*International Conference on Renewable Energies and Power Quality* (ICREPQ'11)
Granada (Spain), 13rd to 15th April, 2011

# Comparative Analysis of a New Planetary Transmission With Deformable Element Usable in RES

O. Climescu[1], R. Săulescu [1], C. Jaliu[1], D.V. Diaconescu[1] and M. Neagoe[1]

[1] Department of Product Design and Robotics, Transilvania University of Brasov
29 Eroilor Boulevard, 500036, Brasov, Romania,
Phone/Fax number:+40 268 472496,
e-mail: blackjetster@gmail.com, rsaulescu@unitbv.ro, cjaliu@unitbv.ro, dvdiaconescu@unitbv.ro, mneagoe@unitbv.ro.

**Abstract.** This paper presents the comparative analysis of a planetary transmission with deformable element in both running cases: as speed reducer, respectively as speed increaser.
Bellow is presented a synthesis algorithm to determine the constructive solution of the transmission using a practical application, and namely a micro-hydro power plant, consisting of a Kaplan turbine, the power transmission and an electrical generator.

## Key words

Planetary chain-set transmission, deformable element, renewable energy systems RES, numerical simulation

## 1. Introduction

The use of power transmissions in the RES domain is needed in order to reduce or increase the angular speed of a motor or turbine. For instance, these transmissions are used as speed reducers in PV tracking systems (e.g. the worm drive), while in micro-hydropower plants or in wind turbines as speed increasers (e.g. the Henderson gearbox [3, 8, 5] in wind turbines and the belt transmission in micro hydropower plants [1]).
Generally, the transmissions used in RES are conventional ones, being characterized by large overall dimensions and/or low efficiencies. These disadvantages led to the necessity of implementing new planetary transmissions with reduced dimensions and higher efficiencies.
In order to reduce the transmissions' radial dimensions, it is recommended to use the planetary transmissions. Taking this fact into account, this paper presents the comparative analysis of a planetary transmission with deformable element, proposed by the authors [4], in the two running cases: as speed increaser and as speed reducer. The comparison highlights the transmission properties that allow its implementation in RES.
The transmission proposed by the authors was obtained by applying a conceptual design algorithm. The planetary solutions with deformable element found in the technical literature are graphically systematized in Fig.1. By combining these three solving variants, several structures can be generated [4], from which the structure presented in Fig. 2 represents the final solution that meets the requirements.

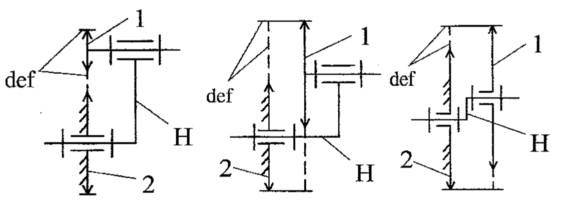


Fig. 1. The planetary solutions with deformable element
Notations: def: deformable element, H-the carrier, 1-the satellite gear and 2-the sun gear

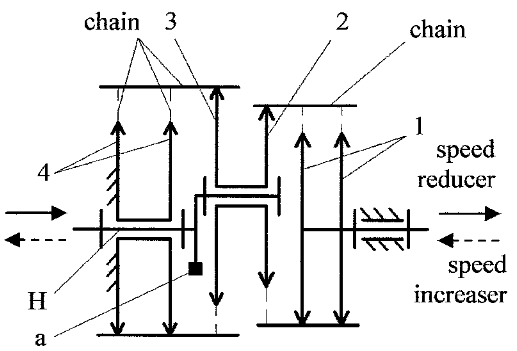


Fig. 2. The principle solution of the transmission

A synthesis algorithm used to determine the gears' teeth numbers for a practically application is further presented. The algorithm requires adopting a transmission ratio for the speed reducer case, and, then, after reversing the power flow, keeping the same value for the speed increaser transmission ratio.
The example of the planetary transmission with i=10 (Fig. 2) is further presented in order to compare the properties of the two running cases. Taking into account this transmission ratio, the internal kinematical ratio can be determined using Willis's relations [2, 9]: