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SPECIFIC FEATURES OF A COUNTER-ROTATING TRANSMISSION FOR RENEWABLE ENERGY SYSTEMS

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Abstract

A specific topical issue both for small hydropower plants and wind turbines refers to the discrepancy between the relatively low speed of the water turbine/wind rotor and relatively high speed of the electric generator: the turbine/rotor has higher performances at lower speeds, while the generator performances are increasing with the speed. Usually, this problem can be solved connecting a proper speed increaser between the turbine (increaser input) and generator (increaser output). Besides, the gearboxes used in the renewable energy systems (R.E.S.) allow generating the necessary electric energy while functioning at lower values of wind speeds or water flows. The paper presents and analyzes cinematically and dynamically a counter-rotating system that contains two coaxial turbines and a generator, connected through a bevel-planetary gear with two inputs (the two turbines) and one output (the generator). The system works relatively different from other drive trains used in the renewable energy systems, while having a much improved efficiency. Firstly, the kinematical and dynamic parameters of the planetary transmission are established in the paper. Then, a case study of a small hydropower plant equipped with a counter-rotating transmission that multiplies 5 times the input speed is analyzed. The numerical simulation results are analyzed in comparison with the classical solutions and recommendations concerning the use of counter-rotating systems are settled up.

Key words: counter-rotating, hydropower, speed increaser, wind

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