SUMMARY

dissertation work of the doctoral of Phd candidate Shingissov Beibit Tumenbayevich on the specialty 6D071200 "Mechanical engineering",

"Justification of kinematic and design data of the electric drive of the generator of the wind turbine"

Relevance of researches. The most important problem of use of wind power is transformation of variable speed of rotation of a wind turbine to the constant speed of rotation of the generator developing electric current. Modern approach to the solution of this problem consists in use of electric and electronic converters of frequency of rotation of a shaft. These converters have low efficiency, complexity of the scheme, low reliability. Failure of any element of a control system leads to termination of work of all design.

Recently self-regulating transmission gears (adaptive gear variators) capable independently to change rotation speed depending on loading were developed. Gear variators were created on the basis of the patent invention "Effect of power adaptation in mechanics" and can be used for change of speed of rotation of the output worker of body depending on loading on it.

However in wind power installation the return technology takes place (the return problem of adaptation takes place). The entrance element of system (wheel) has the variable speed of rotation which needs to be transformed to the constant speed of rotation of the generator. It is advisable to consider possibility of use of effect of power adaptation for transformation of variable parameters of power on an entrance to power with the constant parameter of speed at the exit. Adaptive mechanical transfer could provide independent preservation of constant speed of the movement of working body at the variable input power created wheel only due to properties of the mechanism without use of any control system. Such task wasn't considered earlier.

The main idea of the work consists in using effect of power adaptation for transformation of a variable on the power of wind energy in energy of rotation of a shaft of the generator with a constant angular speed a solution of the return problem of adaptation (by transition from variable parameter to constant parameter) on the basis of use of the self-regulating gear transmission gear of the drive.

It is expedient to make the analysis of the existing drives of wind power installations for a choice of initial parameters, to analyze work adaptive gear stepless adjustable transfer (a gear variator), to investigate possibility of the solution of the return problem of adaptation, to develop a calculation procedure and to develop recommendations about a choice and calculation of parameters of the drive of the generator of wind power installation.

The purpose of work is increase of the technical and economic parameters of the wind turbine due to creation of self-regulating structure of the mechanism including ветроколесо, an adaptive gear variator, the generator, the electric motor providing constancy of operation of the generator of the wind turbine at the variable input power of a wheel.

For achievement of a goal it was necessary to solve the following problems:

1. To make the analysis of the existing designs.

2. To develop highly effective structure of the drive of wind power installation and a design of the adaptive transmission gear of the drive.

2. To make the kinematic and power analysis of the developed mechanism of the drive of wind power installation.

3. To establish features of structuring elements of system providing questions of self-regulation and constancy of operation of the generator at the input power.

4. To develop recommendations about a choice of parameters and to creation of the adaptive drive of wind power installation.

Scientific novelty of work consists in the following:

- the return problem of power adaptation is for the first time solved - at the set variable of input power of a wind stream to provide the constant speed of rotation of the generator of wind power installation. Only in this case the generator will develop standard electric current;

- the computer model of a tooth gearing allowing with use of the ADAMS program to receive concrete results of angular speeds, the moments of resistance is developed and to estimate a condition of gear gearing and to define an endurance limit;

Validity and reliability of scientific provisions, conclusions and results is confirmed by a correctness of a problem definition and use of the approved mathematical methods, provisions of theoretical mechanics of the theory of mechanisms, and cars, methods of the theory of power adaptation and adequacy of theoretical and pilot studies.

Practical value

The adaptive mechanical transmission of the wind turbine in combination with the auxiliary electric motor of a shaft of the generator provides independent preservation of constant speed of the movement of working body at the variable input power created winds wheel only due to properties of the mechanism without use of any control system that results in high reliability and depreciation of the drive by 2 – 3 times.

The practical value of results of researches is as follows:

- recommendations about a choice of initial parameters of the drive of wind power installation are developed;

- the technique of the kinematic and power analysis of the adaptive drive is developed;

- the structure of the electric drive of the generator allowing to transform the variable power of a wind stream to generator power with a constant speed of rotation of a shaft is developed;

Realization of results of work

The technique of a choice and calculation of parameters of the drive of wind power installation was introduced in educational process of chair of "Control systems of space equipment" of Almaty University of Power Engineering and Communications for the specialty "Space Equipment and Technologies". The

technique was developed for calculation of the drive of stabilization of the spacecraft in which the variable entrance revolting loadings are transferred to the fading oscillatory process, are minimized and liquidated.

Work approbation

Results of dissertation work were reported and got approval at the international conference "Vivroengineering Procedia 2015" (Krakow, Poland, 2015), at the XXIV International conference "Theory of Machines and Mechatronic systems" (Wroclaw, Poland, 2014), at the international scientific conference "Innovative IN TECH 2013 Technologies" (Hungary, Budapest, 2013), at the II-nd international scientific conference "High Technologies Pledges of a Sustainable Development" (Almaty. 2013), at the international conference "Theories of Cars and Mekhatronnykh of Systems" (Wroclaw, Poland, 2014).

Publications

By results of researches 19 scientific articles, from them 6 articles the international conferences within the country, 4 articles foreign international conferences, 4 articles are published in the international magazines, 3 articles in the magazines recommended KKSON to MES RK, 1 articles in the SCOPUS database. By results of the executed researches the innovative patent RK No. 27324 is taken out.

Structure and volume of the thesis. The thesis consists of introduction, four sections, 57 drawings, 5 tables, the list used sources from 103 names and 2 applications contain the conclusions stated on 120 pages.