ELECTRICAL ENGINEERING

APPLICATION OF A SQUIRREL-CAGE ASYNCHRONOUS GENERATOR IN WIND POWER TURBINES FOR AUTONOMOUS POWER SUPPLY TO CONSUMERS IN JIZZAKH REGION

Alisher Boliev
Teacher,
Jizzakh polytechnical institute
Republic of Uzbekistan, Jizzakh
E-mail: Umidkhudoyberdiev1994@gmail.com

ПРИМЕНЕНИЕ КОРОТКОЗАМКНУТОГО АСИНХРОННОГО ГЕНЕРАТОРА В ВЕТРОЭНЕРГЕТИЧЕСКИХ ТУРБИНАХ ДЛЯ АВТОНОМНОГО ЭНЕРГОСНАБЖЕНИЯ ПОТРЕБИТЕЛЕЙ ДЖИЗАКСКОЙ ОБЛАСТИ

Болиев Алишер Мардиевич
преподаватель,
Джизакский политехнический институт
Республика Узбекистан, Джизак

ABSTRACT

Today, synchronous generators are widely used in the electric power industry to generate electricity. Synchronous generators are mainly effective at generating high power electricity. However, the use of low power synchronous generators is not the best option. Due to the large dimensions of the synchronous generator and the problem of the excitation current and its regulation, the use of this type of generator in low power wind turbines is impossible. Today, asynchronous generators are widely used in small wind turbines. Their small size and weight allow them to be used in low-power wind turbines.

АННОТАЦИЯ

Сегодня синхронные генераторы широко используются в электроэнергетике для вырабатывания электроэнергии. Синхронные генераторы в основном эффективны при выработке электроэнергии большой мощности. Однако использование синхронных генераторов малой мощности не является оптимальным вариантом.

Из-за больших габаритов синхронного генератора и проблемы тока возбуждения и его регулировки использование этого типа генератора в ВЭУ малой мощности невозможно. Сегодня асинхронные генераторы широко используются в ветроустановках малой мощности. Небольшие размеры и масса позволяют использовать их в маломощных ветрогенераторах.

Keywords: synchronous generators, wind turbines, asynchronous generators.
Ключевые слова: синхронные генераторы, ВЭУ, асинхронные генераторы.

Today, synchronous generators are used to generate electricity for various purposes. However, the use of synchronous generators for small wind turbines is not recommended. Asynchronous generators are widely used in low-power autonomous wind turbines. Asynchronous generators come with a squirrel-cage, phase, and also a hollow rotor.

According to the method of excitation, generators are distinguished with capacitive, as well as with inverter excitation. Disadvantages of capacitive excitation of asynchronous generators are in the difficulty of adjusting the parameters of the output voltage. However, battery driven generators capacitors, differ in a simple design, reliability, lack of contacts [1]. In asynchronous generators, capacitors are used for the excitation system to generate electricity.

There are several advantages to using capacitors in induction generators. For example, the speed of power generation time, the complexity of technical requirements, and so on. However, there are a number of disadvantages, for example, the capacitor can only operate at a pre-calculated load limit, and so on[2].

Recent studies show that effective use of low-speed wind energy, development of new types wind turbines and their adaptation to regional conditions will have significant results. Wind characteristics of the wind in a particular region for the efficient use of wind turbines: air consumption, its kinetic energy,

$$E = \frac{mv^2}{2} \quad (1)$$

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When finding an air mass, take a ball of parallel or cylindrical dimensions:

$$E = \frac{mv^2}{2} = \frac{pVv^2}{2} = pAv^3 \quad (2)$$

Surface of a precision wind turbine that obstructs the flow air looks like this:

$$A = \frac{\pi D^2}{2} \quad (3)$$

The calculation of these parameters allows the use of existing energy wind and create a suitable wind pipe design or optimize existing windpipe. According to this formula, power is calculated as follows:

$$N = \frac{\pi p v^3 D^2}{8} \quad (4)$$

If we take the wind energy utilization factor ē = 0.43-0.47, then power takes the form[3]:

$$N = \frac{\pi D^2}{2060}\eta \quad (5)$$

For an electric generator, 5 expressions are written as follows:

$$N = 0{,}5p\,\xi D^2\,V^3 \quad (6)$$

Generator electric power:

$$P = N\eta_m\eta_g \quad (7)$$

Where:

η_m - efficiency of the mechanical transmission of the wind generator,

η_g - efficiency of the generator.

The power of the turbine generator is proportional to the wind speed in third degree. Therefore, when the speed changes over a wide range, energy losses occur in generators due to low efficiency at low loads, and in asynchronous generators, in addition, large reactive currents that must be compensated. To eliminate this disadvantage, turbines use two generator with rated powers of turbines. In light winds the first the generator is turned off. In some turbines, a generator provides also the ability to operate the unit at low wind speeds at low speed with high duty cycle wind energy[4]. The choice of a turbine generator is influenced by three main factors:

1) Output power (kW), determined only by the power inverter and does not depend on the wind flow, battery capacity. More of her called peak load. The output power parameter determines the maximum number of electrical appliances that can be simultaneously connected to the power supply system. Impossible simultaneously consume more electricity than the capacity allows inverter.

To increase the output power, it is possible to simultaneously connection of several inverters.

2) Time of continuous operation in the absence of wind or with weak wind is determined by the capacity of the battery (AB) and depends on power and duration of consumption. If the electricity consumption occurs rarely, but in large quantities, it is necessary to choose an AB with large capacity .

3) The charge rate of the battery depends on the power of the generator itself. Also this figure depends on wind speed, mast height, terrain terrain.

The more powerful the generator, the faster the batteries will be charged, and this This means that battery power will be consumed faster.

More a powerful generator should be taken if the wind at the installation site weak or consumers consume electricity constantly, but in small quantities[5].

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