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Збірник тез XXVI МІЖНАРОДНОЇ НАУКОВО-ТЕХНІЧНОЇ КОНФЕРЕНЦІЇ: ТЕХНОЛОГІЯ-2023

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МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
СХІДНОУКРАЇНСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
ім. Володимира Даля
ЖАНГИР ХАН УНІВЕРСИТЕТ
ANTALYA AKEV UNIVERSITY
ГРУПА КОМПАНІЙ «ПЛАЗМАТЕК»
ГО «ФУНДАЦІЯ «ПРОСТІР»
ГО "АСОЦІАЦІЯ ФАРМАЦЕВТІВ УКРАЇНИ"
ПрАТ „ХІМПРОЕКТ”

„ТЕХНОЛОГІЯ-2023”

матеріали XXVI міжнародної науково-технічної конференції

26 травня 2023 року

Київ, 2023

Технологія-2023: матеріали міжн. наук.-практ. конф. 26 травня. 2023 р., м. Київ. / укладач Є. І. Зубцов – Київ : Східноукр. нац. ун-т ім. В. Даля, 2023. – 408 с.

Адреса редколегії: Східноукраїнського національного університету імені Володимира Даля, вул. Іоанна Павла ІІ, 17, м. Київ, 01042. т.: (050)9045549

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ЗМІСТ

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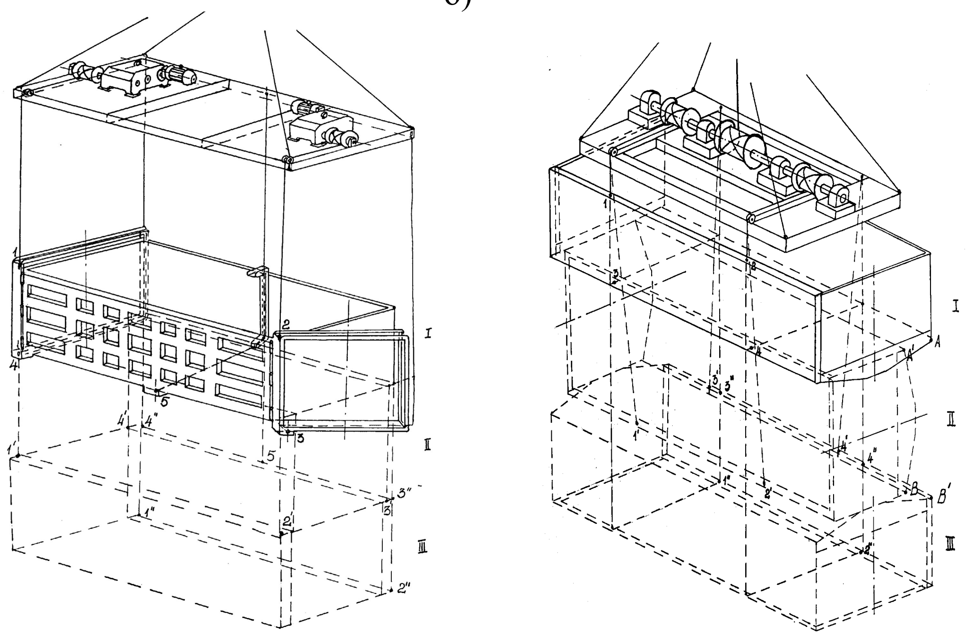

Рисунок 3 – Процес розвантаження ПВ на ВПТ удосконаленої конструкції
а) З розміщенням розвантажувальних канатів по торцевих секціях ПВ;
б) З постановкою рухомого валу з барабанами лебідок замість приводів на рухомій траверсі

Література

1. Візняк Р.І. Дослідження особливостей взаємодії рухомого складу з технічними засобами вантажно-розвантажувальних робіт у залізнично-водному сполученні: Грант Президента України для підтримки наукових досліджень молодих учених. - Дог. № JP/F11/0070 від 21.01.06// № держ. р. 0106U004123.- Харків : УкрДАЗТ, 2006.-144с. URL: https://zakon.rada.gov.ua/laws/show/1279/2005 (дата звернення: 29.10.2021).

DISTRIBUTED SOLAR POWER PLANT SYSTEM WITH POWER FILTRATION FUNCTION

Nerubatskyi V. P., PhD, Associate Professor, Hordiienko D. A., Postgraduate
Ukrainian State University of Railway Transport

Solar power plants are developing significantly both in the industrial and domestic sectors. Increasingly, photovoltaic stations with a nominal capacity of tens or hundreds of kilowatts are appearing near industrial enterprises. Among the power supply facilities, it is possible to single out a group of industrial power consumers of significant capacity, which are characterized by stationary modes of operation. These include electric drive with frequency regulation of oil production plants, ventilation of mines and mining plants, industrial refrigeration units, electric melting furnaces and other equipment. The load schedule of such consumers slowly changes over time [1, 2].

Usually, the specified power supply facilities are the cause of distortion of power network parameters. Passive and active filter compensation devices are used to eliminate their influence on the network and the work of other consumers [3, 4]. On the other hand, the conversion equipment of photovoltaic solar power plants is usually selected with a certain current and voltage margin and is calculated to work in the mode of maximum generation, which corresponds to the maximum solar insolation for the climatic zone where the power plant will be operated. For the temperate climate zone, the maximum solar insolation is reached in isolated cases during the year, which indicates the potential possibility of additional use of the converting equipment as a filter compensation devices.

The purpose of the research is to increase the energy efficiency of the converting distributed system of the solar photovoltaic station with the function of power filtering. To achieve the aim, the following objectives were set:

– to determine the control algorithm capable of implementing multifunctional modes of operation of the solar power plant system;

– present a model of a distributed power supply system.

The paper proposes an algorithm for the conversion system of a solar photovoltaic station, which allows using the standard topology of the power unit to simultaneously implement two modes of operation – the generation of energy from a renewable source to the power network and the correction of the current form in the network. When implementing the algorithm, it is proposed to use the modified p-q-r power theory, which allows to significantly reduce the number of calculations of the microcontroller auto-regulation system.

A model of a distributed power supply system with a solar power plant was developed in the Matlab / Simulink software (Fig. 1).

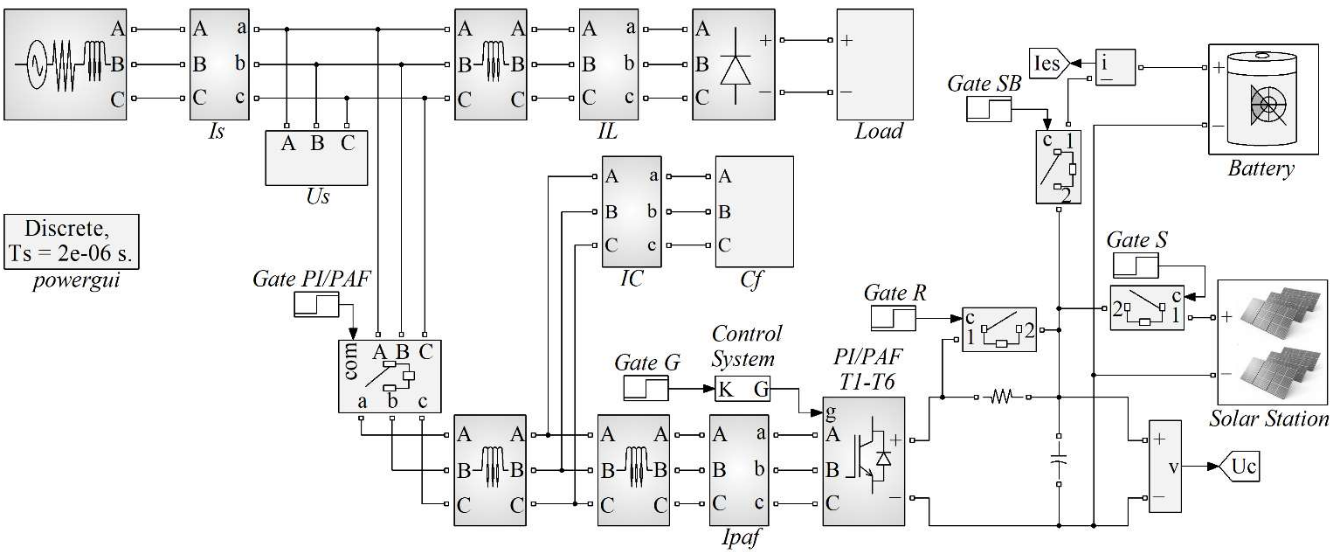

Figure 1 – A model of a distributed power supply system with a solar power plant

Verification of the algorithm on a synthesized simulation model of a distributed power supply system confirmed its correctness in a wide range of changes in load parameters and generation current of a renewable source.

A distributed power supply system with a solar photovoltaic plant provides for the implementation of the following modes of operation:

– generation of energy by a photovoltaic plant to the power network during stable operation of the load;

– power filtering of the network current during stable operation of the load;

– generation of energy by a photovoltaic plant to the power supply network with simultaneous filtering of the network current during stable operation of the load;

– autonomous power supply of the load from the photovoltaic station;

– partial power supply of the load from the photovoltaic station.

Additional modes of operation of the distributed power supply system are modes associated with the use of energy-intensive storage devices (batteries) to equalize the daily load schedule of the transformer station during stable operation. As the simulation results showed, the value of the voltage on the capacitor is maintained by the constant additional control of the charge from the renewable source.

The conducted research will contribute to the further development of the expansion of the distributed power supply system with the introduction of renewable energy sources.

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POWER CIRCUIT OF AN ACTIVE BOOSTING RECTIFIER WITH MODE POWER FACTOR CORRECTION

Nerubatskyi V. P., PhD, Associate Professor, Hordiienko D. A., Postgraduate
Ukrainian State University of Railway Transport

Traction power supply systems are characterized by a number of disadvantages, including: a low power factor, a significant level of emission of higher current harmonics to the power supply network, no possibility of voltage stabilization, as well as a lack of energy recovery from the traction network to the general industrial network [1, 2]. Each of the above factors leads to significant economic costs. Higher current harmonics cause additional losses in the active resistance of the conductors. A low power factor leads to additional costs for reactive power. And the lack of ability to regulate and stabilize the voltage level in the contact network leads to a voltage drop [3, 4].

A rather promising technical solution is the use of active voltage rectifiers with power factor correction. The active voltage rectifier increases the voltage, thereby enabling bidirectional power transmission without changing the polarity of the output voltage, which is a significant advantage for the converter.

The purpose of the research is to increase the energy efficiency of the active rectifier, which implements high quality electrical energy. To achieve the aim, the following objectives were set:

– present the scheme of an active rectifier with a control system;

– determine the parameters of the active rectifier control system.

The most common active voltage rectifier control systems are based on hysteresis modulation. Hysteresis modulation ensures fairly high electromagnetic compatibility with the power supply network and contact network.

In Fig. 1 shows the power circuit of an active rectifier with a hysteresis control system and power factor correction.