<div align="right">

Параметри випробувань.
Номінальний струм короткого замикання, граничне значення 41,8 kA
Швидкість наростання струму 1,22 kA/ms
Струм відключення 13,4 kA
Уставка відключення 12 kA
Комутаційна напруга 2,1 kV

</div>

Рис. 2. Осцилограма та параметри випробувань

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AUTOMATED CONTINUOUS-DISCRETE SUN TRACKING SYSTEM FOR AUTONOMOUS PHOTOVOLTAIC PLANTS

This research aims to enhance the energy efficiency of Automated Photovoltaic Units (APU) by reducing energy consumption for tracking and control operations by at least 30%. This will be achieved through the implementation of an automated tracking control system (ATCS) with a continuous-discrete solar tracking mechanism for photovoltaic batteries, while minimizing energy usage by electromechanical actuators in the tracking system.

The APU solar tracking system operates as an automated process control system at the lower and intermediate levels. Its primary function is to establish a highly efficient control strategy (in terms of APU energy efficiency) for the solar tracking process of photovoltaic units. This strategy accounts for the specific

characteristics of the controlled object, external load impacts, and the need to maximize energy efficiency while minimizing energy expenditure on solar tracking. Additionally, the system ensures seamless transfer of APU control to a human operator during emergency scenarios, commissioning, or adjustment modes, thereby establishing a human-machine interface.

The goal of this work is to improve the energy efficiency of the technological process for electricity generation in APUs. This will be accomplished through the development of an automated control system that optimizes solar tracking to maximize the energy output of photovoltaic batteries. The system simultaneously minimizes energy consumption for tracking and control operations, even under disturbances such as wind loads.

Currently, due to a range of factors such as the depletion of conventional energy resources, rising costs, and the adverse environmental impact of traditional energy production, the urgency of identifying new, clean, and renewable energy sources has become increasingly critical. Within the renewable energy sector, solar power stands out as one of the most promising directions, owing to the ubiquity and inexhaustibility of solar energy.

One of the main drawbacks of autonomous photovoltaic power units is their relatively low energy efficiency. To optimize the performance of solar batteries (SB) in solar energy installations, the following approaches are employed to enhance their energy efficiency:

- Utilization of photovoltaic cells (PV cells) with improved technical specifications, including higher efficiency coefficients [1];

- Implementation of continuous automatic solar tracking systems to align solar batteries with the Sun's position [2];

- Integration of maximum power point tracking (MPPT) systems based on the current-voltage characteristics of solar batteries [3].

The most advanced solar heterostructure gallium arsenide (GaAs) batteries achieve a solar-to-electric energy conversion efficiency of 35–40%, while three-layer gallium arsenide batteries demonstrate an efficiency of up to 45% [4].

Modern silicon-based solar batteries demonstrate the following energy conversion efficiency rates: monocrystalline cells achieve 17–23%, polycrystalline cells 12–15%, and amorphous cells 6–8%. The underutilization of solar batteries in most energy systems, resulting in at least 30–50% energy loss [5], is attributed to the absence of continuous automatic solar tracking systems. Implementing such tracking systems significantly enhances the energy efficiency of autonomous photovoltaic power units (APU).

Improving the efficiency of solar energy systems leads to a significant reduction in the cost of generated electricity. When designing and developing an autonomous photovoltaic power unit (APU), the primary objective is to maximize the electrical energy output of solar batteries (SB). This is achieved through the implementation of an automatic control system (ACS) for electricity production in APUs. Such optimization is possible via highly efficient management of the

photovoltaic system, which requires the development of an automated solar tracking control system (ASTS) for SP and an advanced charge controller for the battery.

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РОЗРОБКА МОДУЛЯ ДЛЯ ПОНИЖЕННЯ НАПРУГИ

Протягом березня – жовтня 2025 року під керівництвом Олександра Лактіонова, доцента кафедри автоматики, електроніки та телекомунікацій Національного університету «Полтавська політехніка імені Юрія Кондратюка» проводилося дослідження щодо розробки модуля для пониження напруги.

Головна ідея полягала у розробці триканального (2 канали 5В та 1 канал 12В) модуля пониження напруги постійного струму, із нестандартним дизайном, для інтеграції у спеціалізоване обладнання [1] або використання окремо.

Перевагами створеного прототипу є наявність роз'ємів для швидкого монтування до носія, виготовлення РСВ в Україні, наявність українських постачальників електронних компонентів, власне проєктування і виготовлення корпусу.