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OPPORTUNITY TO STUDY AND ANALYSIS OF TRACTION ABNORMAL MODE ELECTRICAL COMPLEX MINE ELECTRIC USING THE MACHINE PETRI NETS

Electric transport is the main mode of transportation industrial enterprises in Ukraine. From its efficiency depends largely efficiency of industrial production as a whole.

Recent years have been characterized anticipated revival of the process creating new efficient electrical traction systems based on pulsed semiconductor elements. The scientific activity of the scientists was: the creation and development of traction systems based on transistors and the development of systems based on thyristors [1]. Having the advantages and disadvantages inherent in each of the structures, at the same time, they share a common problem - the presence pre-fault modes to further escalate them to the emergency in the event of failure of control algorithms or failure of individual power units. Therefore it is clear that the effective functioning level of traction systems can not be achieved without addressing the problems of preventive assessment and analysis of possible contingencies, as well as finding ways to overcome them.

When operating electrical traction systems, especially in the mines, there are often non-stationary modes of operation, which can be caused by a number of factors of different nature and have serious consequences for the whole set of equipment. Places of occurrence and localization can be electric traction motors, converter installation, switchgear. Let us dwell on the consideration of the pre-fault modes thyristor-switching converters.

According the results research, semiconductor elements can be in one three states: undamaged, in a state disrepair and breakdown [2]. The largest part of the failure of power semiconductor devices due to the breakdown of the p-n junctions. In addition, there are breaks and blown inland terminals, cracking crystal. Such failures in most cases are a secondary phenomenon, which was before the failure other circuits inverters.

Most typical defects of elements that do not lead to immediate loss earning capacity the rolling stock, but dramatically increase the probability of failure, there are cliffs RC-circuit protection, violation of the voltage feedback mode of electrodynamic braking resistors because of burnout, breakdown diodes with a subsequent breach of the thermal regime of the throttle. This type fault could be detected only in the diagnosis, because they do not have an external appearance. And in the case delayed detection and elimination may fail expensive elements that will ultimately lead to significant capital expenditures.

At breakage RC-circuit on the corresponding semiconductor device power switching unit at the time increased short-term (up to 15 ms) voltage peaks that exceed the rated voltage several times. This leads to a sudden failure of the thyristor or diode and to malfunction locomotives.

One serious problems that do not appear, the battery capacity is decreasing due to the smoothing filter leakage, breakdown, and then blow the part parallel connected capacitors or failure their external connections. This significantly increases the level of the ripple voltage, which leads to higher operating voltages for the power semiconductor devices, and also intensify wear of the traction motors.

A special case of an emergency in the converters is the occurrence of an erroneous pulse the system traction control complex. The decrease in supply voltage or load increase above the allowable level may lead to overload of the converter installation, whereby the switching circuit will be unable to load the switched current.

For the analysis process for taking place in the complex traction and implementation protection devices to choose the right method of research. It will create a security model of the complex, on the basis of which is to be developed appropriate algorithm of the system of comprehensive protection. Analysis of existing methods allowed the authors to focus on the theory of Petri nets [3]. It is believed that Petri net is a research tool systems. This theory enables the simulation of mathematical representation of them as a network. The first fundamental research direction include the award-prof. Sinchuk O.N. and his disciples concerning the traction electric drive. Petri nets are also used in describing processes in various complex systems, such as inverters. Use methods Petri nets primarily for the structural analysis of complex systems, as in our case, because they allow to unify the mathematical tools of analytical studies of individual components and the system as a whole, to formalize the process of synthesis system and visualize the interaction of functional and operational links in the system.

To build a model of the necessary abstraction from specific physical and functional characteristics of its components. System components and their actions seem abstract events.

The event may occur (realized) once or repeated many times, generating a specific action (sale event) or did not occur even once. The set of actions that occur as a realization of events in the operation of a discrete system is the processes occurring in the system. System operates in real-time. Events occurring at some time and last for a while. In models of discrete event systems tied to specific moments or intervals of time, which changes the state of the system. Change of state occurs sequentially. The basic idea is to construct a model - a rejection of the parameter "a" and the interpretation of sequences of states causal relationships between events. Waiver of time allows us to consider events in the model as an instant action. If you need to make a description of the time, then points and intervals represent both

events. Replacement of temporary connections of cause and effect makes it possible to clearly describe the structural features of the system actions. Interactions events described more simply, if not specified connection between the events and situations in which this event can be realized. In this situation, the system formed by operations, which are called the terms of the events.

Fig. 1 show a model with protection against false pulse during charging capacitor switching. In the model, the following notation events and transitions: P2 – open the main thyristor, P3 – the impulse for switching thyristor; P4 – the process of recharging the capacitor switching, switching the load current; P12 – the load current exceeds the switching capacity of the regulator; P13 and P14 – the process prohibiting the formation of the signal; P15 – produced corrective action; t1 – the control system developed momentum of the main thyristor; t3 – a control system developed pulse switching thyristor; t19 – the load current exceeds the switching capacity TYPE; t20 – began to form prohibiting exposure; t21 – FT the formation of the forbidden effect, t22 – correction signal is generated.

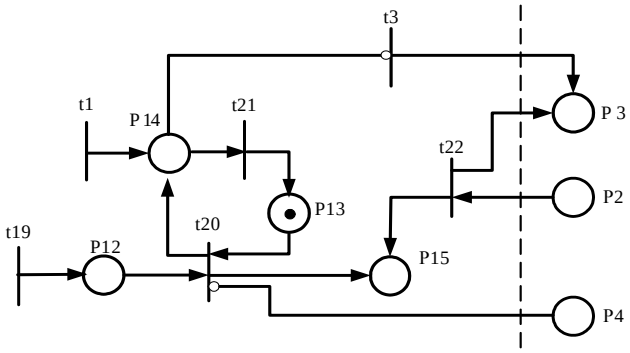

Fig. 1 Model of traction electrical complex with a pulse transformer with protection against disruption by switching the load current exceeds the value limit on the switching capacity for impulse control.

After analyzing this model, we can conclude that an increase in the load current to a level acceptable by the switching ability to drive, you need to create a correction signal and prevent the passage of the control pulses for the duration of the current to a level at which switching is possible.

Disruption of switching thyristor may arise as a result of accession to the pantograph contact network after a long separation, when the storage elements of the power supply is in a discharged state. The appearance of an erroneous pulse in the control circuit of the main thyristor in the period from the connection to the network and the pantograph to the time at which a voltage control circuit is established at a predetermined level will cause switching failure. The emergence of an erroneous pulse control circuit switching thyristor switch will not provoke disruption, since the switching capacitor will begin the process closing at the end of which the switching capacity is restored.

Model of protection against disruption switching is shown in Fig. 2. Designator and transition in the above model: P7 – holding off thyristors host; R8 – the charging of the capacitor switching voltage to a value that corresponds to its switching capacity; P16 – held a switching circuit switching, P17, P18 – the time during which allowed the passage of pulse to the main thyristor; t23 – the main control circuit thyristor has begun preparations for the passage of pulses; t24 – the time has passed, during which the main control circuit thyristor prepared for the transmission of pulses; t25 – is over time, during which the main control circuit thyristor prepared for the transmission of pulses .

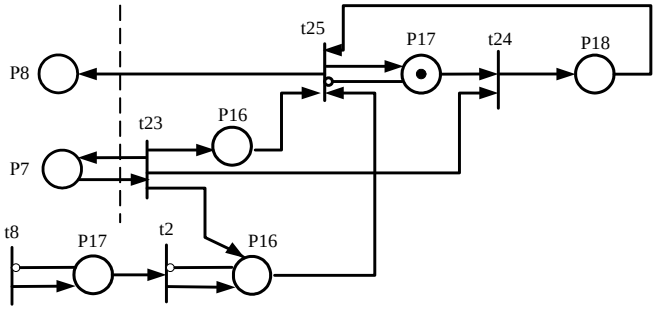

Fig. 2 Model of traction electrical complex with protection against disruption of a false switching pulse in the control circuit of the thyristor.

When the switching converter has cause a circuit to control the switching thyristor erroneous pulse time after which the timer is set, the position P16 becomes marked, and the main thyristor circuit is locked again.

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