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ESTIMATION AND IMPROVEMENT OF THE SAFETY  
OF PHOTOELECTRICAL PROTECTIVE DEVICES  
OF ONE-KNIFE PAPER CUTTING MACHINES

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**Research methodology.** The model of the safety of photoelectrical protective devices (PPD) with applied patterns reflecting the Markov processes which describe the random process of transition from working condition to emergency one and may describe the work of elements at time has been offered.

**Results.** The theoretical analysis of the PPD reliability has been conducted, the results being the calculation figures for estimation of the PPD reliability in a real control system. The empirical diagrams of the interval distribution between the PPD control cycles for the one-knife paper-cutting machines with a number programming control (NPC) have been constructed.

**Novelty.** The mathematical model of the PPD safety with embedded systems of a periodical control in perfect functioning in the form of graph transition has been offered. The solution of differential equations of the PPD finding probability in working condition at any moment of time has been formulated and got. It has been confirmed that the distribution of time intervals between the control cycles caused by a random stream of cutting cycles is characteristic for the exponential law.

**The practical significance.** The use of multi-ray PPD with embedded devices of periodical control essentially improves the safety exploitation of one-knife paper-cutting machines (OKPCM) with NPC. The scheme sample of a multi-ray PPD with periodical control of its safety functioning has been presented, being simple in making and exploitation. Different national laboratory samples of multi-ray PPDs have been used at the laboratory and practical studies during the educational process.