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HOW EFFICIENT ARE THE SYSTEMS OF LIGHTNING PROTECTION OF THE BUILDING?

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Анотація.
Ця стаття містить аналіз різних систем блискавкозахисту, які використовуються в сучасних будівельних конструкціях. У ній розглядаються принципи та методології, задіяні в проектуванні та встановленні ефективних систем блискавкозахисту. У статті підкреслюється важливість таких систем для захисту як структурної цілісності будівель, так і безпеки її мешканців. Оцінено ризики ураження блискавкою одного з корпусів Вінницького національного технічного університету.
Ключові слова: економічна доцільність, блискавкозахист, ризики пошкодження.

Abstract.
This article provides a comprehensive analysis of the various lightning protection systems employed in modern building structures. It discusses the principles and methodologies involved in the design and installation of effective lightning protection systems. The article highlights the importance of such systems in safeguarding both the structural integrity of buildings and the safety of their occupants. The risks of lightning damage to one of the buildings of the Vinnytsia National Technical University have been assessed.
Keywords: economic feasibility, lightning protection, risks of damage.

Introduction

Due to global climate change, thunderstorm activity has significantly increased in Ukraine. This has had a negative impact on the operation of modern power supply systems, which today use a lot of electronic control and communication equipment, computer and microprocessor technology. The protection of human life is of particular importance. Therefore, in recent years, external and internal lightning protection systems have become an integral part of any power supply system project.

This paper studies the risk accounting system on the example of the educational building of the Faculty of Electric Power Engineering and Electromechanics (FEEEM) of Vinnytsia National Technical University (VNTU) and finds out what threats may exist when lightning strikes a building or near it.

The purpose of the study is to analyze the available data characterizing the engineering design of the building as a whole and determine what the risks of injury to people and damage to property may be. To determine the cost-effectiveness of installing an external and internal lightning protection system.

Research results

We analyzed the possible losses from lightning damage to the FEEEM educational building, calculated various types of damage risks, taking into account the location of lightning in an unprotected building. We also compared certain types of risks and made conclusions about the feasibility of developing protection measures for the most threatening components of these risks.

Such a study makes it possible to reduce the likelihood of lightning damage to dangerous levels through the risk management mechanism [1, 2]. We have also made appropriate assessments of the economic efficiency of the external and internal lightning protection system.

This paper shows that the main risk for a given building is the risk associated with death and injury (R1), which is formed mainly through the components of physical damage of the building (RB) and fire or explosion (RV). The risk of economic losses (R4) is additionally formed by the component of failure of internal engineering systems RM (Table 1).

Table 1 shows that the implementation of the proposed protection methods will lead to a sharp reduction in the RB, RV, and RM components, which in turn will increase the level of protection of people and equipment from lightning damage, making the R1 risk less than the acceptable RT risk, as shown in Table 2.

It has also been shown that a significant reduction in risk R4, in terms of cost-effectiveness.

Implementation of the lightning protection system gives a significant positive result in the case when lightning strikes an unprotected building.

Table 1 – R1 and R4 risk values for an unprotected building

Risks	Components	For the building as a whole as a whole, $\cdot 10^{-5}$	Risks	Components	For the building as a whole as a whole, $\cdot 10^{-5}$
R1	R_A	0,515	R4	R_B	11,16
	R_U	0,045		R_V	87,14
	R_B	20,794		R_M	23,8
	R_V	22,19		R_W	0,7
Total risk R1 = 43.54 >> Acceptable risk RT = 1			Total risk R4 = 122.8		

Table 2 – R1 and R4 risk values for a protected building

Risks	Components	For the building as a whole as a whole, $\cdot 10^{-5}$	Risks	Components	For the building as a whole as a whole, $\cdot 10^{-5}$
R1	R_A	≈ 0	R4	R_B	0,5
	R_U	≈ 0		R_V	1,2
	R_B	0,11		R_M	0,4
	R_V	0,12		R_W	≈ 0
Total risk R1 = 0.23 < RT = 1			Total risk R4 = 2.1		

Conclusions

In this paper, a number of studies and calculations have been carried out, which indicate the feasibility of implementing a general lightning protection system for the building of the FEEEM of VNTU.

REFERENCES

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