UDC. 614.841

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USING COMPUTER MODELING FOR SOLVING FIRE SAFETY OBJECTIVES

In the conditions of global informatization, the most important factor of social development and a means of increasing the effectiveness of all fields of activity are modern information technologies. The achievement of a high level of training of future fire safety specialists is based on the constant increase and accumulation of information received, in conditions of uncertainty, limited time, to minimize the risk of erroneous actions. This actualizes the problem of introducing computer modeling in the training of fire safety specialists that satisfy the state of modern society.

Formulation of Problems. The number of fires in Ukraine over the past decade has been steadily increasing, even with population demographic decline and the development of science and technology designed to minimize this phenomenon. This problem is especially urgent at the present time, when there is a transition to flexible regulation of fire safety issues and increasing responsibility of owners and business leaders for providing fire protection to the facility. When performing these tasks, it is impossible to do without the use of computer modeling in fire safety.

The Analysis of Recent Researches and Publications. Significant contributions to the development of information technology on fire safety issues were made by such scholars as: O.H. Dodonov, O.V. Koval, O.Yu. Petropavlovskyi. When studying the disciplines of fire and prophylactic direction it is almost impossible to do without the use of modern computer modeling. Thus, the issue of using new information technologies in order to increase the efficiency of training fire safety specialists is relevant and rapidly developing.

Formulating the goals of the article. To ensure the fire safety of the facility, it is impossible to do without a system analysis. System analysis allows you to determine the features of objects on which it is necessary to assess the state of fire safety; helps to formulate the criteria for assessing the provision of fire safety and the main functional tasks that the management system should perform. It includes computational experiments to simulate various scenarios of fire development, makes it possible to reproduce various calculated fire scenarios, provides an effective implementation of the system and user-friendly interface due to the correct selection and organization of software and hardware, helps to train and control knowledge on fire safety of personnel and visitors to the facility, etc. At the same time, important security solutions can be adopted only with the appropriate training of specialists in this direction. The purpose of the work is to consider computer modeling for solving tasks of fire safety.

Presentation of the main research material. A large number of engineering calculations is conducted in fire prevention activities, they are impossible to imagine without the use of computer modeling.

Simulation of smoke protection is presented as the example of information technology usage in the hydro- aerodynamic calculations [1]. The object of modeling is the room in the high-rise hotel with the standard hotel fire load (Fig. 1).

Modeling defines the time of reaching a critical level of exposure of fire hazards with non-functioning systems of smoke protection and firefighting (Fig. 2, a), with a functioning smoke removal system (Fig. 2, b) and firefighting (Fig.3), rational location of the valve of smoke removal system in the room is defined as well.

One of the types of the smoke protection – is the creation of excess pressure in the protected volume. Model of the fragment of a 16-storey residential building with a staircase of the H2 type (Fig. 4) [2]. Numerical simulation of smoke protection of 16-storey building with a staircase H2 is performed. The calculated parameters of the pump provide pressure of 20 Pascal at 1st floor level (Fig.5).

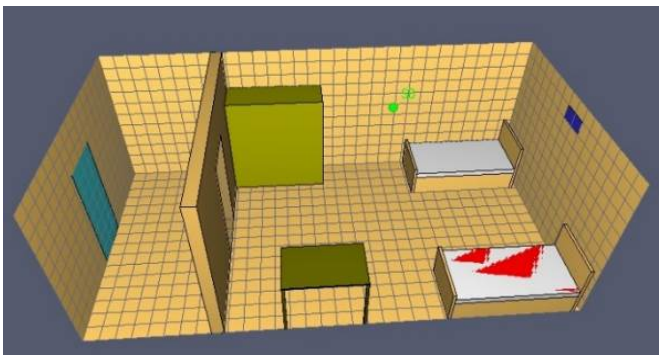
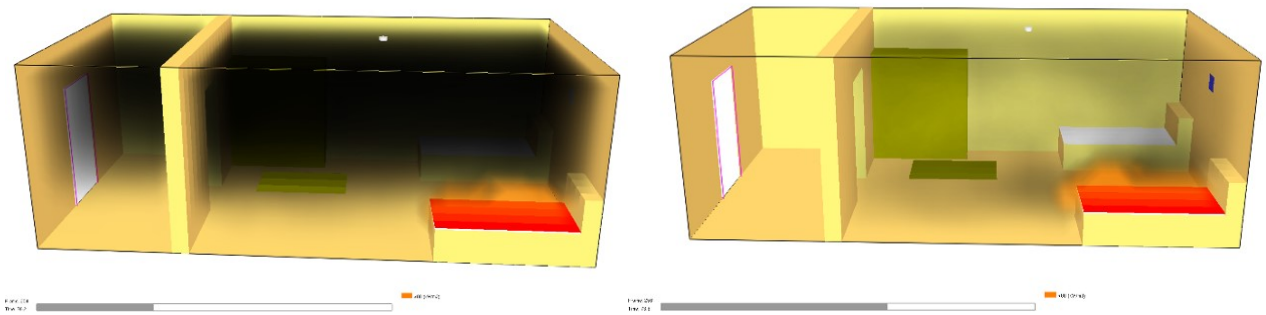


Fig. 1. Model of the Room in a Multistoried Hotel.



a) b)

Fig. 2. Model of the Room without (a) and with the System (b) of Smoke protection (76 sec from the start of the fire).

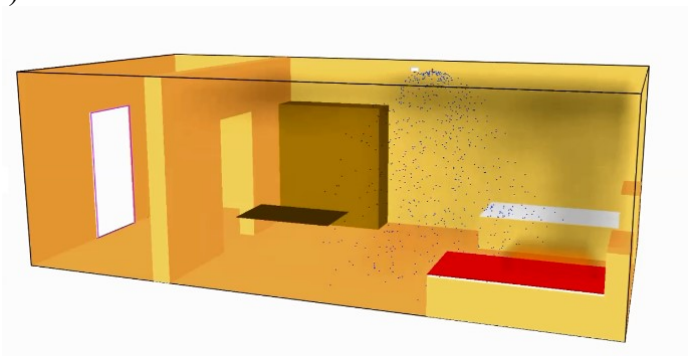


Fig. 3. Model of the room with a functioning smoke removal system.

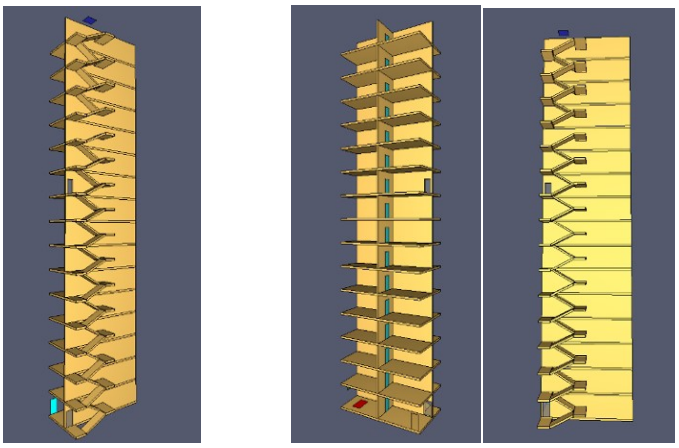


Fig. 4. Model of the fragment of a 16-storey residential building with a staircase of the H2 type.

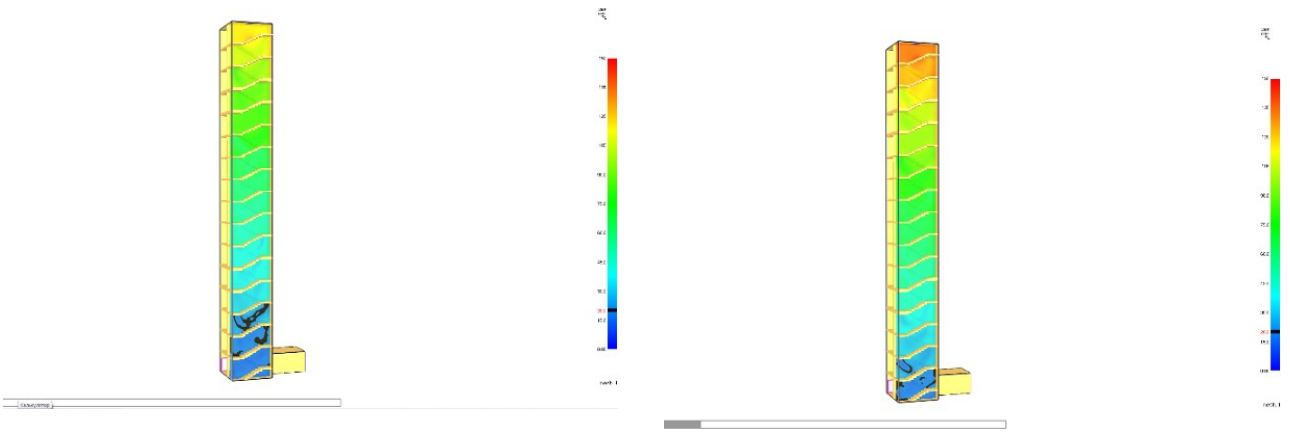


Fig. 5. Fields of pressures in the stairwell H2 at 60 and 180 seconds (black zone – zone of pressure 20 Pascal).

Universal software systems can be recommended for hydro- aerodynamics calculations Ansys [3], FlowVision [4], FDS [5].

It is recommended to use FDS software package to calculate the parameters of fire with the help of the field method [5]. Smokeview - the accompanying program, which displays the output FDS files in a graphic format.

Simulation of several fire scenarios at the educational establishment is presented as an example (Fig.6) [3]. One of the scenarios of the possible fire at the club, the second in the wardrobe have been chosen as the worst-case scenarios of fire development (Fig.7).

Pathfinder – is the software for the design of evacuation in emergencies [6]. Pathfinder allows you to perform calculation of evacuation time and time of existence of crowds using individual flow-motion model (Fig.8).

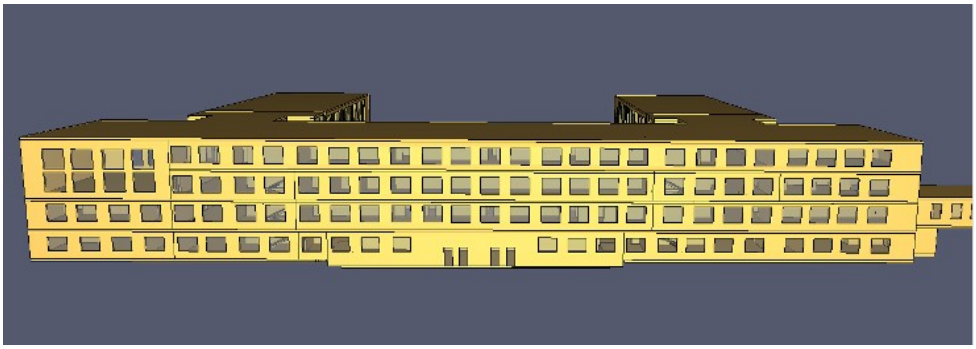


Fig. 6. Model of the educational establishment.

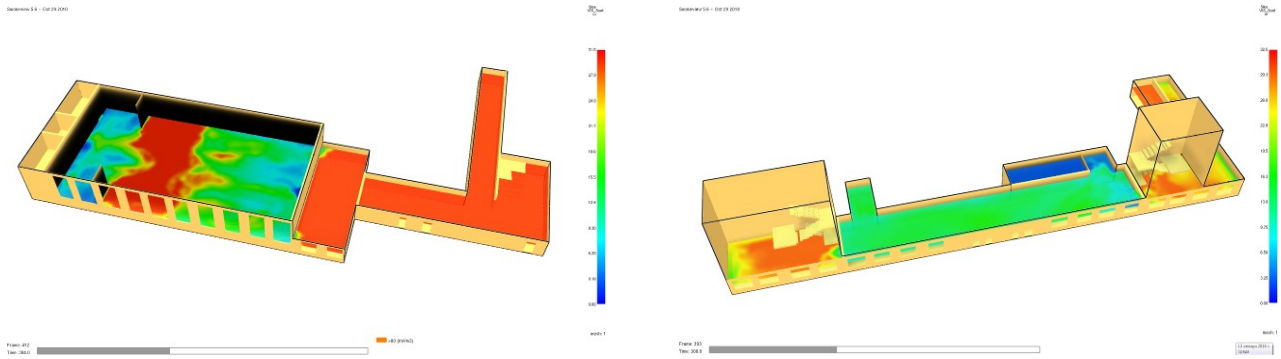


Fig. 7. The fields of vision in cases of conditional fire in the club and the wardrobe

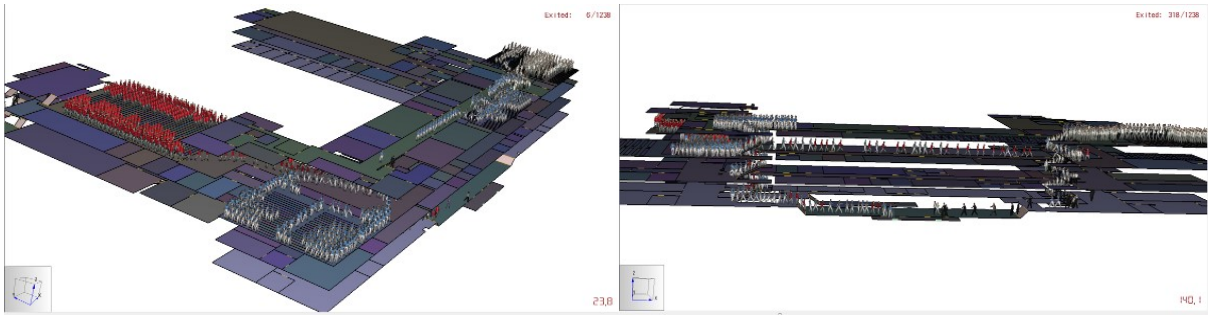


Fig. 8. Simulation of evacuation from the educational establishment.

Interactive 3D-application allows you to visualize simulation results. Virtual tour or interactive 3D-application - a software product that allows you to visualize, navigate, interact with 3D-model.

Interactive 3D-application allows you to organize trainings for remote or dangerous industries. Having 3D-model of a tank farm or a nuclear power plant (Fig..9,10), there is no need to go to the object for training: you can conduct training in the classroom, the student will not only be able to virtually explore the object, but also to play various scenario cases with the instructor.

At the same time to increase the efficiency user can watch the process both from the outside and being inside the virtual object.

Models and results of simulation presented in the article are worked out by the employees of the chair.

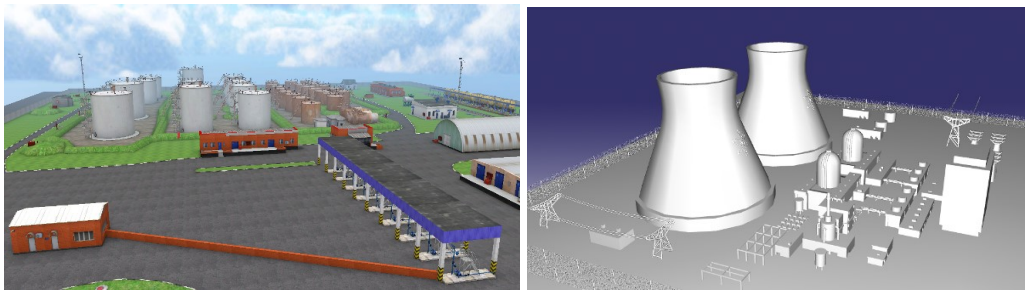


Fig. 9. Models of a tank farms and a nuclear power plant.

Fig. 10. Model of the Premises of Production Enterprise.

Conclusion. The use of computer modeling for solving tasks of fire safety can improve the scientific level, reliability, probative value and visibility of expert's studies and, in general, to achieve a new level of providing fire safety at facilities of different forms of ownership and activities.

Prospects for further researches. Based on the above, and taking into consideration the processes of integration and transition to the European standards and methods of calculation, it is proposed to introduce modern software and training systems, which allow to increase the level of training of specialists of fire and technological safety into education structures of SES of Ukraine.

LIST OF REFERENCES

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ВИКОРИСТАННЯ КОМП'ЮТЕРНОГО МОДЕЛЮВАННЯ ПРИ ВИРІШЕННІ ЗАВДАНЬ ПОЖЕЖНОЇ БЕЗПЕКИ

В умовах глобальної інформатизації важливим фактором суспільного розвитку та засобу підвищення результативності всіх сфер діяльності виступають сучасні інформаційні технології. Досягнення високого рівня підготовки майбутніх фахівців пожежної безпеки полягає в тому, щоб на основі постійного збільшення та накопичення отриманої інформації, в умовах невизначеності, обмеженості часу, мінімізувати ризик помилкових дій. Це актуалізує проблему впровадження комп'ютерного моделювання при підготовці фахівців пожежної безпеки, що задовольняє стан сучасного суспільства.

Ключові слова: *комп'ютерне моделювання, пожежна безпека, інженерні розрахунки.*

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ИСПОЛЬЗОВАНИЕ КОМПЬЮТЕРНОГО МОДЕЛИРОВАНИЯ ДЛЯ РЕШЕНИЯ ЗАДАЧ ПОЖАРНОЙ БЕЗОПАСНОСТИ

В условиях глобальной информатизации важнейшим фактором общественного развития и средством повышения результативности всех сфер деятельности выступают современные информационные технологии. Достижение высокого уровня подготовки будущих специалистов пожарной безопасности состоит в том, чтобы на основе постоянного увеличения и накопления полученной информации, в условиях неопределенности, ограниченности времени, минимизировать риск ошибочных действий. Это актуализирует проблему внедрения компьютерного моделирования при подготовке специалистов пожарной безопасности, удовлетворяющих состоянию современного общества.

Ключевые слова: *компьютерное моделирование, пожарная безопасность, инженерные расчеты.*