BRIDGING KNOWLEDGE AND PRACTICE: SERVICE-LEARNING AS A TEACHING METHOD FOR SUSTAINABLE ENERGY IN ENVIRONMENTAL ENGINEERING

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ABSTRACT: This paper investigates the role of service-learning as an effective teaching method in Environmental Engineering education, specifically within the context of sustainable energy practices. Service-learning, an approach that integrates community service with academic instruction, provides students with hands-on, real-world applications that complement theoretical knowledge. This study explores a project designed to engage Environmental Engineering students in sustainable energy initiatives by partnering with local high schools. University students present and work on a prototype of an energy-independent solar house, which incorporates both solar and geothermal energy systems, to demonstrate practical applications of renewable energy. The objectives are threefold: to bridge the gap between academic learning and practical implementation, to empower students with technical skills in sustainable energy solutions, and to foster a sense of social responsibility towards environmental sustainability. Through interactive learning modules and hands-on activities, students develop a deeper understanding of renewable energy technologies and the engineering principles underlying sustainable infrastructure. Surveys conducted before and after the project evaluate the students' knowledge, technical skills, and engagement with sustainability topics, highlighting the benefits and challenges of this teaching approach. Findings show that service-learning not only enhances students' technical competencies but also strengthens their problem-solving, teamwork, and critical thinking skills. This paper contributes to the growing body of research on experiential learning in engineering education, underscoring the potential of service-learning to foster meaningful learning experiences and prepare students for the pressing challenges of sustainable development.

ADAPTIVE DISCRETIZATION OF COMPLEX PLANAR CRACK SHAPES FOR NUMERICAL ANALYSIS

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ABSTRACT: This study presented the development and implementation of a robust discretization algorithm for the numerical analysis of complex planar crack shapes. The algorithm utilized adaptive Delaunay triangulation and introduced an innovative method for generating control points on the boundary and within the domain. A hybrid approach was implemented for mesh generation, combining boundary-fitted discretization with structured interior point generation. The developed program allowed precise control of mesh density through the h0 parameter and ensured uniform transition between boundary and interior elements. The results demonstrated the algorithm's capability to generate high-quality meshes for arbitrary geometries, with superior control of element shape and size. Numerical validation confirmed the method's efficiency in terms of element quality, convergence, and adaptability to various geometric configurations. The Python implementation facilitated integration with other numerical analysis tools and provided a flexible platform for further developments.

LSTM, ELM AND BPNN METHODS FOR FORECASTING THE WATER FLOW. A CASE STUDY FROM ROMANIA

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ABSTRACT: The water resources management must be based on accurate models of the river's water flow, taking into account the water discharge alteration due to the anthropic influences and climate change. In this context, this aims to determine the best model among three artificial – intelligence techniques (AI) - Long Short-Term Memory (LSTM), Extreme Learning Machine (ELM) and Backpropagation Neural Networks (BPNN) for the monthly data series discharge of the Buzău River, in Romania. The models were built for three periods: January 1955 - September 2006 (S1 series), January 1955 - December 1983 (S2 series), and January 1984 - December 2010 (S series). In terms of Mean Absolute Error (MAE), the best performances were those of ELM on both Training and Test sets on S2, with $MAE_{Training}$= 5.02 and MAE_{Test}=4.01. With respect to MSE, the best was LSTM on the Training set of S2 (MSE=60.07) and ELM on the Test set of S2 (MSE = 32.21). Accounting for the R^2 value, the best model was LSTM on S2 ($R^2_{Training}$ = 99.92%, and R^2_{Test} = 99.97%). ELM was the fastest, with 0.6996 s, 0.7449 s, and 0.6467s, on S, S1, and S2, respectively.

EVALUATION OF DROUGHT INDICATORS ON NUNTASI-TUZLA LAKE BASIN

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ABSTRACT: According to Romania's national implementation report of the UN Convention to Combat Desertification (UNCCD), prepared by the Ministry of Waters, Forests, and Environmental Protection in 2000, the most drought-affected areas are in southeastern Romania, including Dobrogea, the eastern Romanian Plain, southern Oltenia, and the central Moldavian Plateau. Several lakes in the region mentioned before have recently dried up. In October 2020, Lake Iezer in Călărași County, covering about 400 hectares, dried completely. Similarly, Lake Nuntași-Tuzla in Dobrogea dried up in August 2020. Understanding the parameters describing drought is crucial for water resource management. These parameters fall into two categories: indicators and indices. Drought indicators include variables such as precipitation, temperature, river flow, groundwater and lake levels, soil moisture, etc. Drought indices, on the other hand, provide numerical representations of drought severity, using climatic or hydrometeorological data to assess drought location, severity, and duration.

In this context, a study was conducted on drought indicators in the Nuntași-Tuzla Lake area using meteorological data (precipitation and temperature) and hydrological data (flows) from 1965 to 2021. The data were sourced from the National Meteorological Agency (ANM) and the National Institute of Hydrology and Water Management (INHGA).

The results show: (i) Average annual precipitation is 444.6 mm, with three distinct periods: from 1965-1979, precipitation was above average; from 1980-1994, it was below average; and from 1995-2010, it increased again before declining after 2010, except in 2021. (ii) Average annual temperature at Jurilovca station is 11.3˚C. From 1965-1995, temperatures were below average, except in 1966, 1990, and 1995, while from 1996-2021, they were above average, except in 2003. (iii) The average annual flow is 0.348 m^3/s for the Nuntași River and 0.082 m^3/s for the Săcele River, with a negative balance throughout the period.

THE CARBONATION PROCESS IN REINFORCED CONCRETE STRUCTURES

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ABSTRACT: Carbonation is a major degradation process for reinforced concrete structures, affecting various types of structures such as residential buildings, bridges, industrial buildings, historical buildings and tunnels. The process begins with the penetration of carbon dioxide ($\boldsymbol{CO_2}$) from the atmosphere into the concrete, where it reacts with calcium hydroxide, forming calcium carbonate. This reaction lowers the pH of the concrete and once the carbonation reaches the reinforcement, it destroys the passive layer that protects the steel from corrosion. The corrosion of the reinforcement leads to cracking and spalling of the concrete, accelerating structural degradation.

For each type of structure, there are specific prevention methods, such as waterproofing additives, protective coatings, drainage systems and reinforcement with special mortars. Regular maintenance and continuous monitoring are also essential to prevent the progression of carbonation and protect structures in the long term.

This article analyzes how each type of structure is affected differently by carbonation and presents effective prevention solutions, contributing to increased durability and reduced long-term repair costs.

INVESTIGATION OF FIRE CASES ON THE TERRITORY OF THE REPUBLIC OF MOLDOVA

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ABSTRACT: The investigation of fire cases constitutes the set of organizational, technical and operative actions, which includes specific methods and procedures in order to establish the circumstances in which the fire occured, its probable cause and its consequences.

There is increasing concern about the impacts of global warming on fire frequency and severity. Factors such as increased heat, humidity, the drying effect on vegetation, and wind patterns can all affect the way the fire occurs. As a result, fire prevention has become extremely important. The risk of fire is among the most frequent risks that occur on the territory of any country, its occurrence representing an emergency situation, a phenomenon that affects important areas of economic and social activity (buildings, installations, landscaping, forests, means of transport, agricultural crops, etc.).

Highlighting the most frequent causes of fires, their dynamics, ensures the permanent improvement of legislation, fire safety regulations, the development of prevention actions as well as the development of educational programs to train society in order to minimize the risks of fires, losses of human lives and material damage as a result.

DISASTER PREVENTION, RESPONSE, RELIEF AND RECOVERY

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ABSTRACT: Disaster prevention, response, relief and recovery are key functions within the mandate of the GIES. Its overall responsibilities range from people and property protection in emergency situations, from conducting rescue operations and elimination of the consequences of an emergency situation to the organization of prevention, preparedness and mitigation activities.

Considering the above, GIES has the obligation to timely and operatively inform the population regarding the risks of emergency and exceptional situations, to investigate fire cases and emergency situations in the administrative area served, as well as to organize and carry out prevention activities.

In accordance with the Law of the General Inspectorate for Emergency Situations no. 93/2007, GIES ensures the dissemination of information regarding the prevention, liquidation and limitation of the consequences of emergency and exceptional situations. Subsequently, one of the basic tasks of the GIES is the organization of the preliminary and multilateral preparation of the population and the civil protection forces for actions in case of danger or outbreak of exceptional situations and fires.

In accordance with the Law No. 271/1994 regarding civil protection, the inspectorate has the attribution of training the population in the field of civil protection.

In other words, according to the Law No. 267/1994 on fire protection, the basic responsibilities of the subunits of the professional rescuers and firefighters service are the prevention and extinguishing of fires. At the same time, the bodies of the rescue service and professional firefighters are obliged to inform the population about the fire safety of the objectives.

MANAGEMENT OF PREVENTION AND RESPONSE ACTIONS IN CASE OF FIRE

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ABSTRACT: Fires are extraordinary random phenomena that cause specific emergency situations, accompanied by major material damage and, very often, human casualties. Fire prevention is carried out through a complex of organizational, technical, information, training and education actions and measures, as well as material insurance, designed to prevent the outbreak and spread of fires, to create conditions for quick notification, evacuation and rescue of people, protection material assets and effective firefighting.

MANAGEMENT OF EMERGENCY SITUATIONS IN SHOPPING CENTERS

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ABSTRACT: The outbreak of fires is manifested by the violation of the fire protection regime, by non-compliance with the rules and regulations when re-compartmentalizing rooms and installations, by non-compliance with fire safety requirements when modifying some processes, by incorrect operation of installations and fire protection systems, electricity supply, other aspects.

Due to the technical characteristics of shopping centers, their territorial location, fires can occur in the given blocks at any time. In order to avoid such situations, it is necessary that the constructions and facilities meet the fire safety requirements, and that the staff of the given institution, as well as the visitors, are trained to know the rules of behavior in case of fire.

In this paper, an analysis is made of the degree of compliance or non-compliance in terms of fire safety of these institutions, a wide range of problems and solutions regarding the avoidance of unpleasant situations are addressed. A situation is simulated as if the fire broke out, the measures regarding the organization of the intervention, the security measures are carried out accordingly, the economic calculation regarding the intervention of the fire team is carried out.

EMERGENCY MANAGEMENT AT A TYPE INSTITUTION KINDERGARTEN-NURSERY

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ABSTRACT: The main purpose of the study, is to identify the safety measures that will facilitate emergency situations management of a public institution of kindergarten-night type. Different physical phenomena such as open fire, heat, smoke, sound, sparks... etc., can be used as clues in order to understand when the combustion process starts. Fire can be caused by the violation of the anti-fire regime established by the authorities and institutions. The gross violation of fire safety measures increase the risk of fire, significantly. Thus, assessing the fire hazard, evaluating and improving the ways we can combat the triggering reasons for fire apparition is essential.

Fire prevention in preschool institutions plays a very important role for the safety of children and staff. In order to keep this construction in good working order and out of any danger, it is important to implement some rigorous measures, which can significantly reduce the fire risk. In order to prevent fires at these institutions, it is necessary to plan and organize evacuation drills, placing the evacuation plans in accessible places, the use of construction materials according to the regulations, organizing informative sessions for children and staff, the supervision of risks...etc. It is important to both implement and apply these measures in every day practice in order to reduce the risks of fire in kindergarten institutions.

INVESTIGATION OF CRACK GEOMETRY EFFECTS ON STRESS INTENSITY FACTORS AND FATIGUE LIFE PREDICTION USING ADVANCED NUMERICAL METHODS

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ABSTRACT: This study investigated the influence of crack geometry on stress intensity factors and fatigue life prediction in three-dimensional bodies using advanced numerical methods. The research developed a comprehensive computational model integrating finite element analysis for analyzing planar cracks of various configurations. For the purpose of this study, several crack geometries, such as parallelogram, square, and complicated cracks, were analysed, and the mesh densities ranged from 36 to 332 elements. Results demonstrated that stress intensity factors varied significantly with crack shape, showing up to 30% difference between configurations. The model achieved 98.5% accuracy compared to experimental data for standard geometries and provided new correlations between geometric parameters and fatigue life prediction. This integrated approach provided new insights into crack behavior prediction and structural integrity assessment.

ANALYSIS OF STRESS INTENSITY FACTORS IN WELDED JOINTS OF STEEL LATTICE GIRDERS

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ABSTRACT: This study investigated the behavior of stress intensity factors (SIF) in welded joints of steel lattice girders. The study was prompted by the significant occurrence of failures in these structures with more than 60% of all steel structural failures documented in the last decade [1]. The specific hypothesis tested was that joint geometry and crack configuration significantly influence SIF values. The objectives included evaluating the stress intensity factor (SIF) for various crack sizes and assessing the influence of geometric parameters on crack propagation. The methodology involved a comprehensive analysis of existing numerical modelling results using the finite element method (FEM) and a critical review of experimental validations conducted through photoelasticity and strain gauge techniques [2,3]. Results demonstrated a significant increase in SIF with relative crack length and highlighted the importance of mixed-mode loading in girder nodes [5,7]. The conclusions provided guidelines for optimizing joint design and inspection strategies, contributing to improving the durability of steel lattice structures.

ENSURING THE DURABILITY OF REINFORCED CONCRETE CONSTRUCTIONS

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ABSTRACT: The durability of reinforced concrete structures is a critical factor in maintaining long-term safety and functionality, having a direct impact on maintenance and repair costs. Exposure to aggressive environmental conditions such as freeze-thaw cycles, chemical or atmospheric agents, and water infiltration can accelerate degradation processes. Among the most common mechanisms of deterioration is corrosion of steel reinforcement, which occurs in the presence of water and oxygen, aggravated by factors such as chlorides or carbon dioxide. Chemical degradation, caused by acids and salts, affects the internal structure of concrete, while erosion and cracking due to shrinkage and expansion caused by temperature can compromise the integrity of the construction elements. To prevent such damage, rigorous design and use of high quality materials capable of withstanding aggressive environments is required. Advanced protective measures, such as applying special coatings on reinforcements or using additives, help to extend the service life of the construction. Thus, durability not only ensures the stability and safety of the structure, but also brings long-term economic benefits, reducing the need for frequent rehabilitation and contributing to the sustainability of modern construction.

EVALUATING THE MECHANICAL AND THERMAL PERFORMANCE OF STEEL-WOOD-STEEL JOINTS UNDER FIRE CONDITIONS

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ABSTRACT: This study presents a comprehensive analysis of the mechanical and thermal behavior of steel-wood-steel (SWS) joints used in wooden structures, tested under ambient conditions and fire exposure. Investigations evaluated the initial stiffness and load-bearing capacity of SWS joints made of laminated wood and softwood (Radiata Pine and Glulam) with variable diameter steel dowels, tested at different wood densities and thicknesses of passive protection materials such as gypsum and laminated wood panels. The results show that the char rate of wood and load-bearing capacity are significantly influenced by wood density, dowel diameter, and the type of protective material. While Eurocode 5 proposes standard values for the char rate, the results obtained show significant variations depending on the structural configuration and type of protection used. Through comparative tables and a critical analysis, suggestions are made for adjustments to standard formulas to better represent the structural behavior of SWS joints under real loading conditions and exposure to fire.

INTEGRATED STRUCTURAL HEALTH MONITORING SYSTEM BASED ON SIF ANALYSIS AND ARTIFICIAL INTELLIGENCE: A METHODOLOGICAL PROPOSAL

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Abstract: The rapid evolution of structural monitoring technologies highlights the need to develop more efficient and accurate systems for detecting and evaluating defects in steel structures. Ensuring the safety and integrity of critical infrastructures, such as bridges, buildings, and utilities, is a major challenge in the field of engineering. Fluctuations in loading, unfavorable environmental conditions, and the appearance of defects can lead to structural deterioration, with potentially disastrous consequences. To address this challenge, advanced monitoring systems have been developed that combine modern sensor technologies with Artificial Intelligence (AI)-based analyses. This study proposes an Integrated Structural Health Monitoring System (ISHMS) that uses a sensor network and machine learning algorithms to continuously evaluate the Stress Intensity Factor (SIF) of infrastructures. The system has the ability to detect, locate, and estimate the evolution of critical defects, allowing for preventive interventions and risk reduction.