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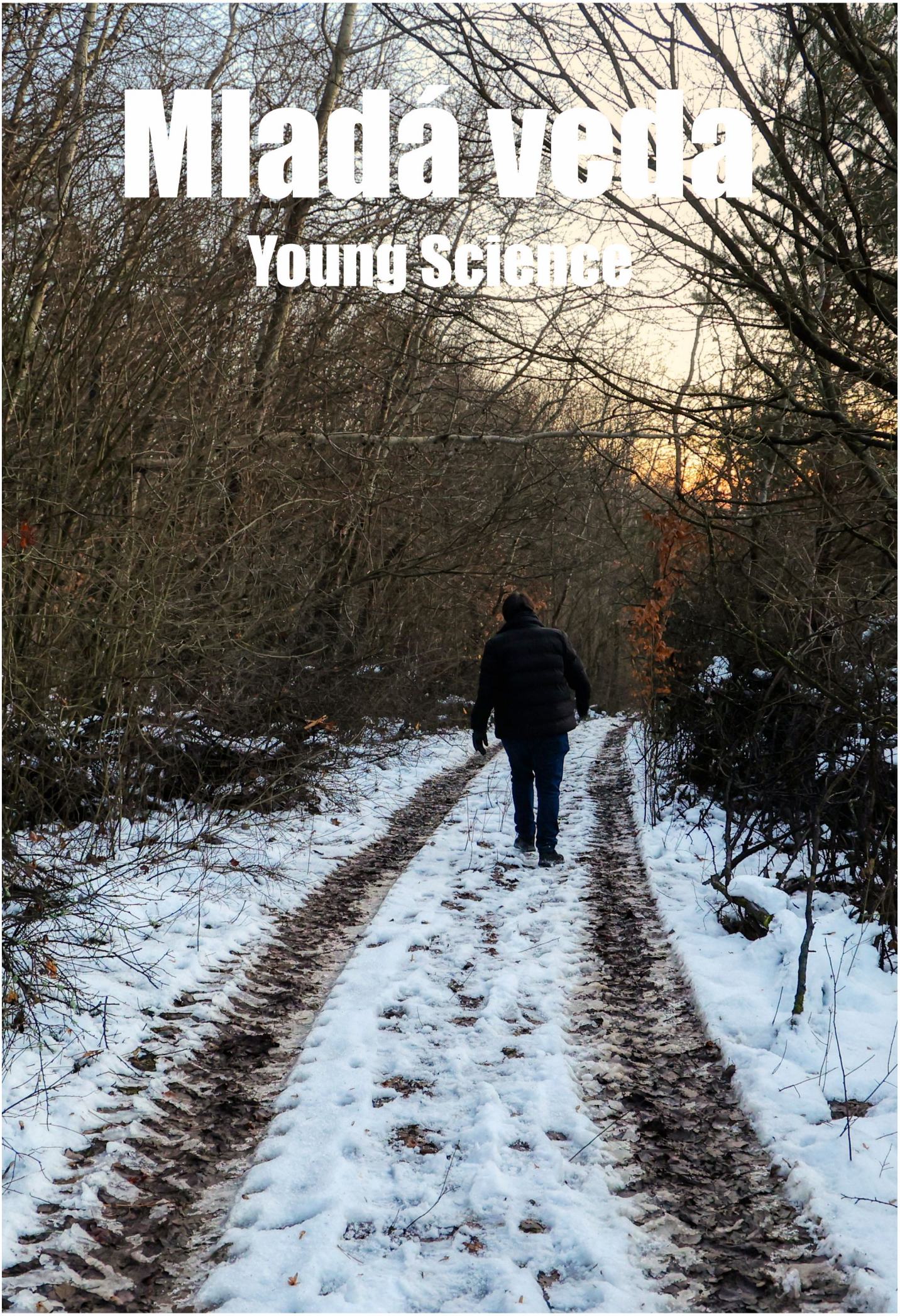

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RESIDENTIAL BUILDINGS OF INTERWAR ARCHITECTURE FROM THE POINT OF VIEW OF THE NEGATIVE INFLUENCE OF RISING MOISTURE

OBYTNÉ BUDOVY MEDZIVOJNOVEJ ARCHITEKTÚRY Z POHĽADU NEGATÍVNEHO VPLYVU VZLÍNAJÚCEJ VLHKOSTI

Patrik Šťastný, Zuzana Šišková [1]

Patrik Šťastný pôsobí ako výskumný pracovník na Katedre technológie stavieb Stavebnej fakulty Slovenskej technickej univerzity v Bratislave. Vo svojom výskume sa venuje analýze vybraných protivlhkostných sanačných technológií historických konštrukcií, najmä na oblasť invazívnych, resp. priamych metód sanácie a taktiež aj na technológie fungujúce na princípe magnetokinézy. Zuzana Šišková je interná doktorandka na Katedre architektúry Stavebnej fakulty STU v Bratislave v odbore Teória a konštrukcie pozemných stavieb. Venuje sa problematike architektúry prvej polovice 20. storočia s témou dizertačnej práce: Príspevok k aplikovanému výskumu obytných budov z medzivojnového obdobia (z hľadiska rôznorodosti tvarového, konštrukčného a materiálového riešenia) so zameraním najmä na matematickú analýzu proporcií.

Patrik Šťastný works as a researcher at the Department of Building Technology, Faculty of Civil Engineering, Slovak University of Technology in Bratislava. In his research he focuses on the analysis of selected anti-humidity remediation technologies of historical constructions, especially in the field of invasive and direct remediation methods as well as technologies operating on the principle of magnetokinesis. Zuzana Šišková is an internal doctoral student at the Department of Architecture, Faculty of Civil Engineering, STU in Bratislava, in the field of Theory and Construction of Earth Structures. He deals with the issue of architecture of the first half of the 20th century with the topic of his dissertation: Contribution to the applied research of residential buildings from the interwar period (in terms of the diversity of shape, construction and material solutions) with a focus mainly on the mathematical analysis of proportions.

Abstract

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This contribution approximates the circumstances of massive housing construction after the First World War and focuses on the theoretical level on possible solutions to the problem of moisture in these objects and proposals for possible rehabilitation technologies. Renovating interwar architecture, especially when dealing with issues like rising damp, requires a thoughtful and specialized approach. Interwar architecture, which generally refers to the period between World War I and World War II, often features unique design elements and construction techniques. Rising damp, a common problem in older buildings, can compromise the structural integrity and aesthetic appeal of these constructions.
Key words: remediation, rising damp, additional impermeable layers, interwar architecture

Abstrakt
Tento príspevok približuje okolnosti masívnej bytovej výstavby po 1. svetovej vojne a v teoretickej rovine sa zameriava na možné riešenia problému vlhkosti v týchto objektoch a návrhy možných sanačných technológií. Renovácia medzivojnovej architektúry, najmä pri riešení problémov, ako je vzlínajúca vlhkosť, si vyžaduje premyslený a špecializovaný prístup. Medzivojnová architektúra, ktorá vo všeobecnosti odkazuje na obdobie medzi 1. a 2. svetovou vojnou, sa často vyznačuje jedinečnými dizajnovými prvkami a konštrukčnými technikami. Vzlínajúca vlhkosť, ktorú považujeme za bežný problém v starších budovách, môže ohroziť štrukturálnu integritu a estetickú príťažlivosť týchto štruktúr.
Kľúčové slová: sanácia, stúpajúca vlhkosť, dodatočné nepriepustné vrstvy, medzivojnová architektúra

Introduction

After the First World War and the creation of the Czechoslovak Republic in 1918, there was an urgent need to provide housing for the new economic and administrative structure of the state. This need was reflected in the construction of rental apartment buildings for the middle class of the population and in the construction of family houses and villas for lower and higher managers.

Currently, many buildings are preserved in their original state, but many gradually lose their material and material essence under the pressure of modernization. Improperly chosen renovations or construction modifications of buildings, whether due to the ignorance or lack of information of their owners, take part in this. Renovation is largely influenced by the degree of identification or disidentification of the owner with the building, financial means, standards and needs of today, and last but not least, energy efficiency and legislation.

Unfortunately, there is no suitable methodology for the restoration of 20th century buildings in Slovakia, which would guide the renovation of these important buildings. In 2015, the Methodological Center of Modern Architecture in Brno published the professional methodology of the National Monuments Institute focused on the historic restoration of villa architecture of the 20s and 30s of the 20th century, as well as many other methodologies in connection with the restoration of objects of the last century in the sense of ensuring a suitable restoration methodology. As stated in the Methodology for the Evaluation and Protection of Buildings of the 2nd Half of the 20th Century, the term construction rehabilitation means an intervention that improves the condition of a partial entity and the functioning of the whole,

without removing the essence of the given thing (removal of plaster, but not masonry when dealing with moisture; adding an element,...) [1].

In this paper, the authors focus mainly on the problems caused by rising damp, which attacks various types of buildings, not only those of the interwar period, and it is necessary to solve this problem. Moisture in objects is a global problem, which is discussed in several foreign articles. For the sake of interest, we can refer to the publication of the author Franzoni [2], who makes known an article that points out that approximately half of the renovations in Belgium are related to rising damp and that the importance of this problem is similar at the European and international level [3]. The publication of the Roman architect Vitruvius [4], who describes certain methods of combating moisture in his work, also proves that the problem of moisture has been obvious for a long time and that humanity is trying to solve this problem. Subsequently, the authors did not manage to find a mention of the fight against moisture, and therefore it is assumed that this problem was not solved for many centuries, or solved only to a small extent. It wasn't until 1892 that Kenwood published an article entitled Moisture in and around houses [5], where he drew attention to the fact that a humid environment has a negative effect on the health of people who stay in such objects for a long time. Unfortunately, his research was ignored for many years. It was only in 1989 that the European Council adopted a directive on construction products [6], which in a certain form stated suitable environmental conditions. Specifically, the basic condition of the absence of moisture in the masonry was included as one of the requirements meeting the hygienic and health purposes of the building.

It is clear from the above that this problem did not escape even the buildings of interwar architecture. Therefore, it is necessary to pay extra attention to these buildings as well, as there are no professional publications, articles and methodologies focusing on moisture removal.

Description of the rising moisture principle

The phenomenon of wetting can be observed most often in the lower part of the building. Specifically, in the part that is in direct contact with the terrain. This is where moisture is absorbed and transported in the pores of building materials.

Capillary upwelling is a multiphase phenomenon that combines the effects of various driving influences. It can be said that the capillary rise of moisture is a phenomenon due to the occurrence of adhesive forces between water and capillary surfaces compared to the cohesive forces of water itself [7].

The phenomenon of rising humidity has been investigated by several scientists. He was the first to describe the rise of water in an ideal cylindrical pipe with radius r Laplace, followed by Jurin. The latter expressed the height of water rise, denoted as h, which was observed in an ideal capillary with radius r.

The law defined by Jurin can be simplified, especially in the case of porous constructions, for example, made of bricks, which are characterized by high wettability. However, the equilibrium line, i.e. the height of the water rise, which separates the dry and wet zone, is much lower in the structures than in the capillary, which is placed in an ideal laboratory environment. This phenomenon occurs due to the evaporation of water and the

tortuosity (entanglement) of the pores on the surface of the wall. Thus, the height of the degree of wetting is the result of the interaction between the rate of water evaporation, the penetration of water into the structure and the structure of the materials, such as the amount of pores and their size, discontinuity, etc. [7]. These parameters result in the so-called dynamic balance, and thus the balance between water absorption and water loss caused by evaporation. The given values of the humidity of the structure are also influenced by various seasonal factors, such as the change in the groundwater level, air humidity, but also the air flow caused by the ventilation of the premises. Observations from the field indicate that the rise height is usually around 0.5-1.5 m [8, 9].

Description of selected rehabilitation methods

The presence of moisture in structures, and not only historical ones, is one of the most widespread problems of buildings in our climate zone. The most effective method of eliminating moisture in the structure is to prevent this phenomenon, especially with the help of regular and appropriate maintenance [10]. Unfortunately, with older objects and historical buildings, we often encounter neglect of ongoing maintenance. This subsequently leads to smaller faults, which over time grow into larger ones.

Protection of buildings against water and moisture is one of the most important measures in terms of ensuring their longevity and functional capacity [11].

There are many methods of preventing moisture from building up in objects. Their precise description and division is solved by several publications, led by the publication by the author Makýš [12], which divides the technologies intended for moisture remediation according to the construction-physical and implementation point of view (Figure 1) into seven main groups.

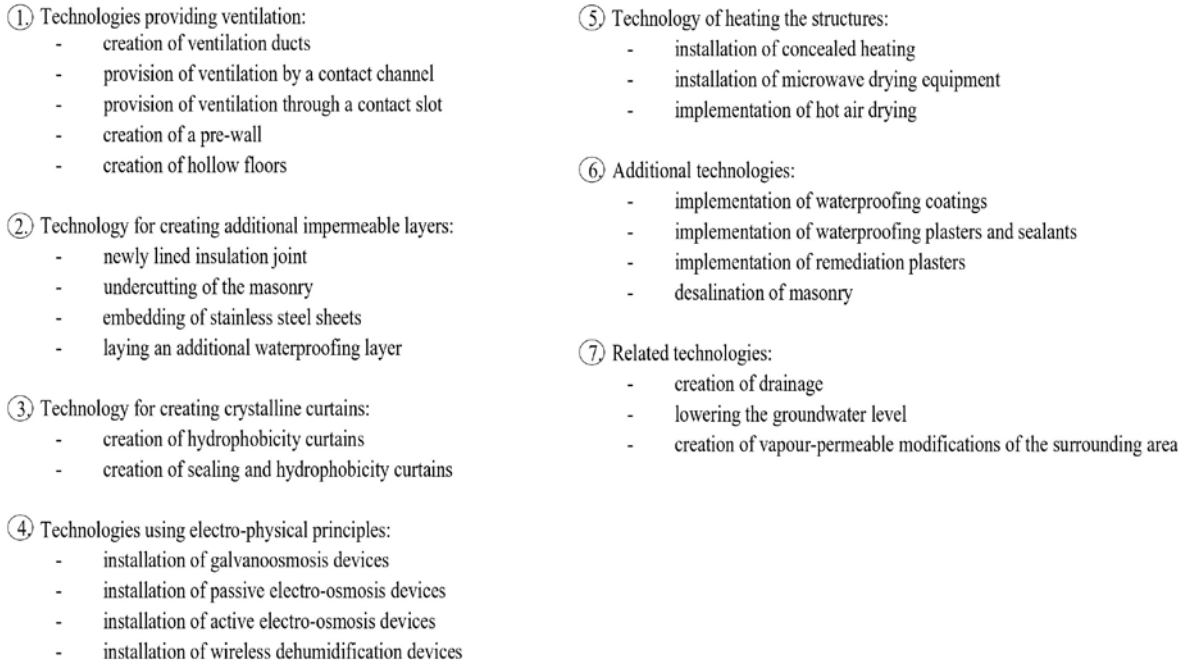

Figure 1 – Division of methods intended for rehabilitation of constructions
Source: [12]

Within the published contribution, we will focus only on the description of selected technologies that can be considered invasive and in a certain form radical, but research proves that the given methods are highly effective. Among the methods described are mainly methods belonging to the second and third groups according to Figure 1.

Technologies of additional impermeable layers

The history and origin of these technologies can be dated several centuries back, when the idea of creating barriers in the wall to stop the rise of moisture arose. It was used to insert dense volcanic stone just above the floor level and, thanks to its low porosity, it was supposed to prevent the rising of water.

Already in 1827, N. Cavalieri San-Bertolo dealt with waterproofing [13]. He suggested inserting lead plates into the structure itself already during construction. Subsequently, in the 60s of the 20th century, the idea and proposal of creating barriers against capillary rise in existing structures was formed with the help of mechanical cutting of the walls and the subsequent application (insertion) of a waterproofing layer.

The principle of these rehabilitation methods consists in the implementation of a new horizontal or vertical waterproof waterproofing, so-called insulating screen, the application and placement of which is ensured by pressing, inserting or inserting into the cross-section of the structure [14]. Various insulations are used for these technologies, from waterproofing based on asphalt strips to profiled sheets (nickel, chromium nickel, etc.). They are implemented in successive steps from plastering, or surface treatment and the creation of a new storage joint intended for waterproofing, through the insertion of the additional waterproofing in question, to the filling of the joint with expansion mortar and subsequent final treatment of the surface of the structure.

The effect of such an intervention on the architectural side of the object is clear, but with a suitable methodology for restoring the damaged plaster layer, it has no subsequent effect on its mass-spatial arrangement. Buildings of the 20th century largely serve their original requirements to this day, and therefore it is necessary to look for alternative solutions that will ensure the necessary conditions for the internal environment of buildings. We should not understand the use of invasive interventions as the only possible way, but we should also not avoid them in the case of an urgent need for the rehabilitation of endangered objects

Technologies for creating crystalline courtains

Crystal curtain technologies were created as a possible alternative to undercutting structures, especially in places where it is not possible to apply undercutting due to insufficient access, etc.

Their application consists in pouring a chemical substance into pre-drilled holes in the renovated structure. With the aforementioned screens, it is necessary to focus mainly on the duration of action of the sealant in the masonry. The functionality of this technology is influenced by many factors, but recent research indicates that the development of technology and construction as such has also significantly helped to advance the application of crystal screens. They achieve positive results on several construction sites.

The implementation of these technologies does not require space requirements as in the implementation of technologies of additional impermeable layers, which is positive from the point of view of its application. However, there is a problem when the masonry can contain cavities, where a significant amount of substance gets after application and it is necessary to supplement the given area with another substance.

From the point of view of preserving the material-spatial concept of objects as well as their environment, the application of this method of rehabilitation is a good choice. However, as with any invasive intervention, it is necessary to consider the impact on the structure and the subsequent adjustment of the structures to the form before the application in order to achieve the original visual.

Conclusion

From the above, it is clear that there is an increasing need to deal more intensively with this problem as a comprehensive solution to the restoration and sustainability of objects of interwar architecture.

In many cases, the application of the above-mentioned methods can appear as a radical step in the restoration of objects of interwar architecture. However, from the point of view of the possible inclusion of these objects in a possible monument restoration, it would be necessary to consider the deployment of just such technologies in the event that non-invasive technologies are not effective enough to prevent the rise of moisture. This can gradually disrupt the structure, which will be exposed to weather effects, constant freezing and thawing, and subsequently lead to the destruction of the object.

It is necessary to pay increased attention to individual technologies, whether invasive or non-invasive, their degree of effectiveness and appropriateness of deployment.

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