Abstract
In recent years, the deontological synergism has recruited many researchers in the field of exploration of the interaction of integral construction facility at all stages of its life cycle, and the surround environment. In designated area, there is a continuing observation of particular singular linguistic, technical and scientific uncertainties, false understandings and interpretations. This knowledge inspired the subject research in order to eliminate perceived, whereby resorted unusual draft research, which was the plan, structure and strategy helped finding answers to a set of selected research questions noetically recognized, holistically formulated and logically systematized: What makes integrated building structure at the level of partial functional units; Can it be built and used as a dedicated integrated building structure without compromising the environment; What can only and only be the subject of observations on the basis of energy efficiency in integrated building structure; in what correlation are integral building structure and thermotechnics; What is a function of sophisticated objective function of thermotechnical systems represented in the integral building structure; What correlation do integral building structure and energy and efficiency make; Can the energy efficiency of the building be determined as a partial functional mid integral construction of the facility; Can a part of the building as a partial functional unit of an integrated construction facility contribute to energy efficiency and other partial functional units contained in the integrated building structure; Is there an integral construction facility "zero energy" and "zero plus energy"; What are the forms of interaction of integrated building for all stages of its life cycle with its surrounding environment; Is energy being "consumed" or "used"; Are guidelines properly formulated: "thermal energy", "energy performance of the building structure", "building physics", “architectural physics” and "Energy efficiency of buildings." Using the method of causal-conclusion analysis with inductive concluding, the answers were obtained which eliminated doubts and false understandings and interpretations, and the same are also of axiomatic nature leaving no space given opportunities to be bypassed in engineering practice, profession and science. The present work aims to contribute to proper and efficient communication and objective investigation of subject matter, and thus contribute to environmental protection and sustainability of Planet Earth.

Keywords - building structure; thermotechnics; environment; Planet Earth
1. Introduction

Civil engineering is a unique area of human multidisciplinary and creative work whose outcome often combines functionality and aesthetic appeal, raising admiration both in experts and laymen. The primary product of civil engineering is an integral building structure which has a definite purpose, composition, content, size and originality. The life cycle of an integral building structure consists the following phases: construction of the structure (phase I); use of the structure for the intended purpose during its lifespan (phase II); demolition of the structure at the end of its lifespan (phase III); sorting the remains into recyclables and non-recyclables (phase IV); disposing of the non-recyclables to landfill (phase V); and recycling of recyclable remains (phase VI). During its life cycle, an integral building structure is in a constant complex bidirectional interaction with the environment.

Over time and space, civil engineering has evolved in both quantity and quality terms thus mainly improving its creations, interpretations and contents. However, some technical professions and disciplines are becoming less significant, their views less valued and respected so that they are actually being pushed out of civil engineering, while a more lucrative approach to this field is becoming more and more favoured. One of the disciplines that do not have the rightful place is thermotechnics, even though it constitutes an irreplaceable and permanent part of civil engineering [6]. Consequently, controversial language expressions, professional and scientific ambiguities and mistakes, misconceptions and misinterpretations have become so common in the field of thermotechnics in civil engineering that they are causing short-term or/and long-term damage. A comprehensive study and analysis of professional literature including various written materials and oral presentations given at scientific meetings have yielded the results presented here.

The interest for this research has been additionally enhanced by deontological synergism based on Kant’s categorical imperative and Ostwald's energetic imperative.

2. Research methodology

Certain controversial language expressions, professional and scientific ambiguities and mistakes, misconceptions and misinterpretations have been noticed in the above stated field. The terminology used has the following meaning: “ambiguity” is a dilemma between two possibilities; “mistake” is unintentionally made wrong opinion, estimate, attitude or procedure, as a result of critical consideration; “misconception” includes all explanations or comments that are obviously opposite to the truth as established by science.

Once these language singularities have been identified, they can be classified into four characteristic groups: a group of controversially formulated language expressions and syntagms, a group of ambiguities, a group of mistakes and a group of misconceptions and misinterpretations. A few characteristic examples chosen from each group were used to formulate research questions. Answers to these questions were
obtained using the causal-conclusive analysis method and deductive reasoning. This method was used to establish a direct relation between the studied language singularity and its actual source, after which logical reasoning is used to draw specific conclusions from general principles. The obtained conclusions are, in fact, answers to the raised questions.

Since our research is limited to the field of thermotechnics in civil engineering, it is necessary to define thermotechnics. Thermotechnics is a powerful branch of science that originated in physics. It studies, interprets, develops and applies the following: principles and laws of phenomena accompanying changes in properties, composition and state of matter; methods and means to generate, transfer, distribute and use heat; and finally, processes and means to generate other forms of energy from heat or by means of heat. Thermotechnics may conveniently be divided into theoretic and applied, which are in constant bidirectional intensive interaction. Furthermore, theoretic thermotechnics can be subdivided into thermodynamics and mass and energy transfer, while the applied thermotechnics is subdivided into energetic (thermoenergetics), industrial, technological (process) and communal. Thermotechnics is an open technical discipline which uses other disciplines and which is used by other disciplines [4].

3. Research questions and answers

Concise research results are presented based on a question-comment-answer principle.

**Question:** Are the following expressions or syntagms acceptable?

- “Heat energy”: Heat is merely a form of energy which cannot have any other implication or connotation; therefore using the word “heat” together with the word “energy” makes an obvious pleonasm. The fact that it is necessary and sufficient to use only the word “heat”, makes this formulation unacceptable.

- “Civil engineering physics”; “Architectural physics”; etc.: Actually there is only one physics, a fundamental science that can be and is applied in different areas, and as such it does not deserve nor allow to be subordinated to other disciplines. Therefore, these expressions are unacceptable. It is necessary and sufficient to use expressions such as “applied physics in civil engineering” and “applied physics in architecture”.

- “Energy is spent”, “Heat is spent”: The law of conservation of energy states that energy cannot be created or destroyed just transformed from one form into another, which means that a certain quantum of energy/heat is taken and used to satisfy our needs. Therefore, these expressions are unacceptable. It is necessary and sufficient to use expressions such as “energy is used”, “heat is used”, “taken quantum of energy”, or “taken quantum of heat”.

- “Energy passport for a building”: a building, i.e. a building part of an integral building structure is a stable, static, and energy inactive system
which does not work, participate in energy transformations or travel so it does need a passport. Therefore, this expression is unacceptable. It is necessary and sufficient to use the expression “certificate of thermotechnical properties of the building part of the integral building structure” [8].

- “Energy efficiency of a building”: Since the term “building” refers to the building part of an integral building structure, the building is a stable, static and energy inactive system which does not work or participate in energy transformations, and consequently energy efficiency cannot be determined and defined for such a system. Therefore, this expression is neither acceptable nor sustainable [5].
- “Energy performance of a building”: the term “performance” has its etymological origins in French, meaning success, achievement, result. It can be used for energy active systems but not for buildings. This expression is also unacceptable. It is necessary and sufficient to use the expression “thermotechnical properties of the building part of an integral building structure”.

**Question:** What comprises an integral building structure at the level of partial functional units?

**Answer:** An integral building structure at the level of partial functional units can consist either of the building part only, or it can include the building part, technical systems, technological systems, installations and equipment, all in accordance with the intended purpose of the building so that its functionality can be achieved.

**Question:** Can an integral building structure be built and used in accordance with its intended purpose with no negative environmental impacts?

**Answer:** An integral building structure is built at a particular site, in an urban or rural area, using materials, semi-finished and finished products and different technologies. While used, during its lifespan, it is in a constant complex bidirectional interaction with the environment. Therefore, an integral building structure cannot be built and used in accordance with its intended purpose with no negative impacts on micro- and macro-environment.

**Question:** What can be “the one and only” study object concerning the energy efficiency of an integral building structure at the level of partial and functional units?

**Answer:** The study of energy efficiency of an integral building structure can refer only to the energy active partial functional units.

**Question:** What is the correlation between an integral building structure and thermotechnics?

**Answer:** Thermotechnics is permanently and irreplaceably present in civil engineering and the correlation between an integral building structure and thermotechnics is strong, positive and unavoidable.

**Question:** What is energy efficiency of a system?

**Answer:** Energy efficiency of a system is a ratio between the actual output and the standard output of an energy active system.
**Question:** What are the forms of interaction between an integral building structure in its all life cycle phases and the environment?

**Answer:** An integral building structure is in constant bidirectional interaction with the environment in its all life cycle phases. This interaction presents itself in many forms such as extensive chemical and physical pollution of the soil, water and air, use of non-renewable natural resources (minerals, energy producing products, water, fertile soil), disruption of biosphere and biodiversity balance, causing climate changes, visual pollution, etc [1].

**Question:** Can “energy efficiency” be identified with the term “energy saving” or considered the same?

**Answer:** The term ”saving” implies certain “deprivation” while efficient use of energy does not involve deterioration of the system functions or/endangerment of human life and/or work; therefore these two terms cannot be regarded as the same.

**Question:** What is the function of sophisticated thermotechnical systems in an integral building structure?

**Answer:** In an integral building structure, one or several separate sophisticated thermotechnical systems can be found, depending on the type and the intended purpose of the building structure and on the functional capacity of sophisticated thermotechnical systems. Each sophisticated thermotechnical system has functional and working capacity as its representative properties, and none of these systems can be expected to perform outside the range of its functional capacity. In integral building structures, the following sophisticated thermotechnical systems can be used: heating system (HS), cooling system (CS), ventilating system (VS), air-conditioning system (ACS) and sanitary hot water preparation systems (SHWPS). These systems are named after their functional capacity and function.

- **Heating system** (HS) has functional capacity to simultaneously achieve, maintain, control and regulate only the ambient air temperature \(X_{1.1}\) as a microclimate state parameter, within allowed limits \(\Delta X_{1.i}\), in time periods when the outside air temperature is lower than the prescribed limit temperature;

- **Cooling system** (CS) has functional capacity to simultaneously achieve, maintain, control and regulate only the ambient air temperature \(X_{1.1}\) as a microclimate state parameter, within allowed limits \(\Delta X_{1.i}\), in time periods when the outside air temperature is higher than the prescribed limit temperature;

- **Ventilating system** (VS) has functional capacity to simultaneously achieve, maintain, control and regulate only the ambient air temperature \(X_{1.1}\), as a microclimate state parameter, within allowed limits \(\Delta X_{1.i}\), an unlimited number of microclimate composition parameters \(X_{2.i}\), within allowed limits \(\Delta X_{2.i}\), and an unlimited number of microclimate aerodynamics parameters \(X_{3.i}\), within the allowed limits \(\Delta X_{3.i}\);

- **Air-conditioning system** (ACS) has functional capacity to simultaneously achieve, maintain, control and regulate the unlimited number of microclimate state parameters \(X_{1.i}\), an unlimited number of microclimate
composition parameters \((X_{2,i})\), and an unlimited number of microclimate aerodynamics parameters \((X_{3,i})\), within the allowed limits \((\Delta X_{1,i} \Delta X_{2,i} \Delta X_{3,i})\), during a calendar year;

- **Sanitary hot water preparation systems** (SHWPS) has functional capacity to simultaneously achieve, maintain, control and regulate the temperature and the amount of sanitary hot water at each tap in the given space during a calendar year.

It is important to point out that the design of sophisticated thermotechnical systems such as heating system, cooling system, ventilating system and air conditioning system must take into account composition, content and properties of the building part of the integral building structure, while the design of the system for sanitary hot water preparation must take into account the composition and the content of the building part of the integral building structure. However, thermotechnical properties of the building part of the integral building structure have no significant effects on these systems [2,3].

The local device for heating, cooling or both heating and cooling is quite often referred to as “air conditioner” which is incorrect because it does not have the functional and working capacity of an air-conditioning system.

**Question:** What is the correlation among an integral building structure, energy and efficiency?

**Answer:** An integral building structure could not be built without the use of energy and it could not be used in accordance with its intended purpose, which means that energy is present in its all life cycle phases. Efficiency can be considered and analysed in all life cycle phases of the integral building structure but only if energy activity is also present. Efficiency can be separately analysed in the manufacture of raw materials, semi-finished products and finished products.

**Question:** Can one determine the energy efficiency of the building part as a partial functional unit of an integral building structure?

**Answer:** Considering the fact that the building part as a partial functional unit of an integral building structure is stable, static and energy inactive, its energy efficiency cannot be determined.

**Question:** Can the building part as a partial functional unit of an integral building structure contribute to the energy efficiency of other partial functional units contained in the integral building structure?

**Answer:** All partial functional units of an integral building structure are designed in compliance with their partial design tasks. All these partial design tasks have to be mutually synchronized and synchronized with the integral design task. Only the integral building structure built in compliance with the designs of its partial functional units can fulfill its intended function. Active partial functional units are conditionally independent concerning their own energy efficiency. The building part cannot have a significant influence on energy efficiency of other energy active partial functional units.

**Question:** Is there an integral building structure of “zero-energy” or “zero-plus-energy”?

**Answer:** Each integral building structure goes through different life cycle phases having their authentic energy scenarios. During each phase, a certain quantum of
energy is used irreversibly. The exact amount of this energy can be determined at the end of each phase. Life cycle phases of the integral building structure are hierarchically ordered and successive, meaning that the next phase can start only if the previous one is completed. The transition from one phase into another involves transfer of the whole amount of “energy mortgage”, which means that “energy mortgage” from the finished phase cannot be neglected - it has to be transferred to the next phase where it represents the starting point. This process continues to the end of the life cycle. Once the life cycle of the integral building structure is finished the final energy balance can be calculated, i.e. the total amount of all forms of energy used in a given integral building structure is determined. Among other things, this shows its impact on the environment. An integral building structure contains partial functional units which ensure that its integral function is achieved. When the integral building structure is connected to the communal infrastructure in an urban or rural area, now active partial functional building units can fulfil their functions thus also enabling fulfilment of the integral function. The energy needed for active functional building units of the integral building structure is supplied by the infrastructure network. However, the energy needed by the active partial functional units at the stage when the integral building structure is used in accordance with its intended purpose can be substituted via an additional partial unit. This additional unit can be of the same, less or higher capacity compared to the needs of the active partial functional units at the stage when they are used in only accordance with the intended purpose, i.e., at the stage when the integral building structure is used in accordance with its intended purpose. Each additional partial functional unit subsequently integrated into the integral building structure in order to partially, entirely or excessively satisfy its need for energy at the stage when it is used in accordance with the intended purpose (but not at other stages) fundamentally changes the purpose of the integral building structure and increases its “energy mortgage” from the moment it was installed. This active partial functional unit can use renewable or non-renewable energy sources or energy generating products to accomplish its function. In order for an integral building structure to be considered “zero-energy” or “zero-plus-energy”, an active partial functional unit (which provides energy to the integral building structure at its all life cycle phases) should be added at the very beginning of its life cycle so that the “energy mortgage” transfer could be avoided. However, this is not possible. A subsequently added active partial functional unit that provides energy to the integral building structure when it is used in accordance with the intended purpose cannot retroactively annul the “energy mortgage” of the already realized life cycle phases, nor can it provide energy for the phases to come till the end of its life cycle [8].

4. Conclusion

The study here presented has indisputably determined the existence of numerous controversial expressions, syntagms, ambiguities, mistakes and misconceptions in the field of thermotechnics in civil engineering. This may well be the result of the facts that thermotechnics is not present enough in civil engineering, that the views of experts in thermotechnics are not valued enough, or that the experts are too reluctant to take measures to prevent occurrence of such mistakes and their further spreading. Based on
the study results, it can be concluded that this tendency to use ambiguous or inadequate expressions should be counteracted. This would not only prevent their further use and spreading but it would also prevent manipulation of investors and building residents by lucrative stakeholders.

Energy, i.e. heat, is of vital importance, hence it should be regarded in accordance with the “energy imperative” saying that “energy is not to be wasted but used rationally”.

It is well-known that civil engineering negatively impacts the environment, but with the damage caused by the studied language singularities, these negative impacts become even more severe and dramatic. This paper will hopefully contribute to eradication of ambiguities and misconceptions and to prevention of their further development. Furthermore, it will hopefully contribute to preservation of the environment which is endangered despite the fact that it is irreplaceable.

References