A. SUMMARY

With the help of the composite materials, it is possible to realise a large sort of applications with parametres corresponding to the proposed purpose and at advantageous prices. From a constructive point of view, composite materials are a combination of two or more materials with known properties for each component in order to obtain a material with new and better properties. Various combinations can be made between materials such as: materials of the same type, metals with metals or ceramics with ceramics; materials with different physical and chemical properties such as glass or carbon fiber with epoxy resins. Generally, a composite consists of a ground material (matrix) which exhibits weaker properties but has a low cost price, reinforced with other types of materials, of different shapes, topologies and dimensions with very good mechanical, physical or chemical properties but with low costs. Composite materials have caused a real revolution in industry, especially towards the end of the last century, and continue to develop with the same power now because they have many advantages: they take on some useful properties in designing a machine or parts of its components and removes some disadvantages that would arise when using only one element.

The major advantage of the composites and the particular development of these materials is due to the fact that a large number of parameters can be varied which will finally yield the properties of the composite. Hence the great range of properties that can be obtained in this way. Different materials can be put together with different physical and chemical properties, with different shapes and sizes in different proportions. Another advantage of the composite is that it can have some properties better than the properties of each component. For example, it is known that for certain composites the thermal conductivity is better than the thermal conductivity of each phase. However, as a general rule, this only happens for some of the properties of the composite, and a certain property or characteristic will usually be between the values of its components.

From the engineering point of view, the importance of a composite material consists in the possibility of achieving an optimal compromise in order to obtain a material with special properties and low cost. There are other reasons why composite materials have become important. In the modern, highly industrialized world, there is a continuing pressure of public opinion to reduce activities that may affect the environment (especially mining or metallurgy). Energy management in order to save it is another reason why composites have such a development. There are thus enormous opportunities for the use of composite materials. They are more resistant, lighter, easier to manufacture, with less impact on the environment, have lower prices, and are not affected by limited quantities of raw material as is the case with classical materials. Also, energy consumption with manufacturing is lower and has a lower impact on the

environment, most of the composites being recyclable. Using composite materials, we can produce more durable, smaller, lighter, more comfortable cars and car components with a longer life and lower cost.

In the first section we studied the influence of temperature on the mechanical properties of some polymeric matrix composites. The mechanical properties of glass fiber reinforced composite subjected to bending stresses were studied. The study was conducted to determine how the temperature influences these properties. It is noted that with increasing temperature the bending strength of the material will decrease. It follows that heating during the operation of mechanical systems comprising such composite materials leads to a decrease in the values at which these components may be destroyed. This decrease is quite important and we have to signal that glass fiber-reinforced polymer matrix composites will be easily destroyed even at very low temperatures (in our case 65 ° C to 20 ° C, ambient temperature ambient). It has also been found that in case of heating (which in practice can be accidental) after which the material is brought to the initial temperature, it does not lose its bending mechanical properties. At this time, there is sufficient data to undertake systematic future research on the behavior of high temperature composite materials, as it has been found that the heating composite response is significantly different in terms of its mechanical properties. The results that will be obtained from these studies that we propose to do will be extremely useful to designers working with reinforced fiberglass material.

Another direction of research was an identification of the properties of certain types of polymeric matrix composites used in the construction of motor vehicles. The properties of low-density propylene (LDPE) reinforced with short glass fibers, RT300 reinforced polyester composite composites and glass fiber-reinforced HDPE polyester composite have been studied. In order to use these composites in vehicle components it is necessary to know what their properties are and how they behave in case of mechanical stresses.

Some of the most used material in vehicle construction is plastics or glass reinforced resins. Their use in design requires very good knowledge of the properties of this material. There are a number of theoretical researches which present methods to calculate these properties but in practice find that sometimes the calculated values may be quite far from the actual values, which is generally due to the fact that different fabrics of the same composite can have quite a number of values different mechanical properties. It is difficult to ensure the same manufacturing conditions within the composites. For this reason it is necessary to determine, in many practical cases, what are the values of the mechanical properties by direct testing on the test machine. The traction tests are most used for these determinations. Based on the tests performed on the traction unit and the values obtained, some conclusions can be drawn regarding the tested materials. Fiber reinforced composite materials of the RT300 type have good mechanical behavior and traction resistance suitable for a number of engineering applications.

The dimensional and structural deviations that occur in the manufacture of fiber-reinforced composites can lead to significant variations in the mechanical properties of these materials. These effects have been studied in the paper. Long-fiber fiber-aligned materials are considered, in theoretical approaches, to be composed of cylinders placed in a regular network. This, in fact, is far from the truth and it is impossible to realize in practice a perfect parallel arrangement of the fibers. Also in the fiber dimensions there are deviations from the cylinder and from the nominal sizes offered by the manufacturer.

These deviations that may be dimensional or structural from the theoretical values may lead to variations in mechanical properties, calculated with simplified theoretical hypotheses. The fibers may not be arranged in a regular network, they may not be parallel and the diameters of the fibers may (often) not be equal. It has been determined how the mechanical properties calculated with the formulas accepted by the literature can influence these imperfections that are commonly encountered in practice. During manufacture of the composite material, but also thereafter, during storage and transport, a series of imperfections may occur in the material due to mechanical action or chemical phenomena such as diffusion phenomena. These may lead to changes that may sometimes be significant in the behavior of composite material and undesirable deviations from predicted theoretical composition of the composite.

Following the analysis of the formulae presented in the paper, it can be concluded that variations in the properties of the fiber or the matrix can generally lead to variations, sometimes significant, in the properties of the composite material.

The behavior of a Heliopol / Stratimat laminated composite material under the action of cyclic bending stresses was analyzed in some papers published and presented in the References. The laminated composite structure is made of HELIOPOL 9431ATYX_LSE reinforced with STRATIMAT300 5-layer fiberglass. A composite specimen was subjected to different displacement sizes to determine the hysteresis behavior of the laminate. To predict the elastic properties of two-phase composites, theoretical approaches are made without any problem using well-known software such as ABAQUS, ANSYS and NASTRAN, etc. For three-phase composites, the prediction of elastic properties can be done by the homogenization method or by variational methods.

Experimental coefficients of linear thermal expansion were determined for the whole structure. Reinforcing materials in composite laminates have been used as glass fiber fabrics and glass fiber panels randomly cut. Reinforcing materials of various specific weights, in combination with glass fabrics, are generally a suitable solution for manufacturing a composite structure required for bending. For example, such structures were subjected to three- and four-point bending tests to determine the most important mechanical properties.

RT300 glass fabric was also used as reinforcement material in composite structures based on polyester resins. Various investigations were made on different composite structures subjected to different complex loads. The upper limit of displacement highlights the strong hysterical character that occurs when using this type of composite material based on HELIOPOL 9431ATYX_LSE resin reinforced with STRATIMAT300 glass fiber fabric weighing 300 g / m^2. The results may be useful in later practical applications using this material and which should take into account the strong hysteretic character.

In the our work are also shown traction tests for the material made of four layers of CSM600 glass fiber fabric and Polylite 440-M888 resin. Described are the breaking patterns encountered in specimens made from four-layer fiberglass reinforced polyester resins subjected to traction tests until final tearing. The CSM600 (600 g / m 2 specific gravity) was used as Polylite 440-M888 polyester resin reinforcing material. The RT glass fabric materials of different specific weights were used as reinforcing materials in composite. They can be easily modeled using the finite element method. Using Nastran / Patran software, various composite laminates subjected to three-point and four-point testing were analyzed.

Carbon fiber reinforcement composites are especially used in practical applications. The most important mechanical properties of three new pre-impregnated composite materials based on epoxy resin 1050 and PLAIN 200 carbon fiber with a specific gravity of 200 g / m^2 were studied in the paper, used in composite panels sandwich, with applications in the aerospace industry. Three types of prepreg type material were developed using single layer, two and three layers and then treated in a pressure and controlled autoclave. Different mechanical sizes for these three materials were recorded using the test machine.

Carbon fiber fabrics are used for both medium and large composite structures due to their high tensile strength and specific weight ratio. These materials have good seating and handling capabilities, a feature that allows them to be used in applications that require complex shapes.

Due to its good mechanical properties (high stiffness), PLAIN 200 carbon fiber epoxy can be used in various types of laminated composites. A preferred application is the use as an outer layer for flat sandwich plates where the core consists of a soft, inexpensive material with low mechanical properties. This type of carbon fiber can be used, for example, in the development of adaptive wings in the aeronautical industry. These carbon fiber materials also have special thermal and electrical properties, which add to the particular mechanical properties of carbon fiber, lead to some extremely useful applications, especially in the aeronautical industry.

The second part of this section is concerned with the development and improvement of scientific research from the point of view of Methods and applied teaching. The study presented in this part was made in accordance with the *National Strategy of Research, Development and Innovation 2014-2020*, the

National Strategy for Tertiary Education 2015-2020 and the *Memorandum of the European Commission* with regard to lifelong learning, adopted in October 2000. This documents invite the states members of the European Union to find coherent strategies and practical measures for the development of continual learning, and also for the development and improvement of scientific research from the point of view of Methods and applied teaching.

From this point of view, in accordance with the studies which were carried out, the development and improvement of scientific research can be achieved by developing the system of initial and continual education and professional formation. The notion of „knowledge triangle“ – education, research and innovation – is a central element of the European Commission Strategy for Education and Formation 2020 (ET2020), being further promoted by the common report concerning the stage of implementation of the ET2020 strategy. The European Council considers that education and professional formation are the background for a proper working of the knowledge triangle, being essential to stimulate research, economic growth and employment. The conclusions of the European Council and the representatives of the governments concerning a growing part of education within the framework of a fully functional knowledge triangle establish several action priorities, among which: pedagogical reform, partnerships with the business environment, developing a culture of inovation and scientific research in higher education institutes and new approaches for the assessment of quality.

The aims are to develop and improve the scientific research also from the point of view of the „knowledge triangle“, as well as to find feasible action procedures to put them in practice, a high quality education which materializes itself through numerous research papers which I gathered in this section. The topics investigated with the purpose of studying this desideratum are: communication, quality, assessment, teaching and management.

Education centres are considered responsible to reach a high level in all the investigated topics, and equally to correlate the educational offer with the labour market, having as a permanent desideratum the development of scientific research, since this aspect of university education is one of the most important and effective instruments to improve the „added value“ in the context of the whole education process.

Regardless of age, en educator has to learn permanently but, certainly, alongside with experience the human competencies are improving, included the research side present in any educator. At the level of scientific research and practice, I consider that we, the educators, should achieve performance in the following areas: scientific, psycho-social, managerial, psycho-pedagogical and communicability, to really and truly be what we have to be.