EDITORIAL OF THE SPECIAL ISSUE - ADVANCES IN THE ADDITIVE MANUFACTURING TECHNOLOGIES

Additive manufacturing, also known as 3D printing, is a process that creates a physical object from a digital design. Additive Manufacturing (AM) can look back to a history of more than 30 years. Started mainly as a technology for physical materialization of a virtual 3D model with reduced usage (checking of right design solutions, promoting of new products and eventually for experimental tests) from a single type of material (photosensitive polymers), the new type of technologies have gradually gained more importance. Nowadays their field of application is very large, from industry to medicine.

The current issue of ROMANIAN JOURNAL OF TECHNICAL SCIENCES – APPLIED MECHANICS, dedicated to this new category of technologies which are known nowadays as Additive Manufacturing (AM) is proper and welcome indeed. This fact is due to the major impact that AM technologies now have and will have in important strategic domains that are foreseen to be developed and implemented, in one of the most remarkable growing rhythm, in the manufacturing history. Meanwhile, the current issue presents few results of the Romanian researchers in this field that were reached at the Technical University of Cluj-Napoca, "Transylvania" University of Brasov, National Institute of Research and Development in Mechatronics and Measurement Technique (INCDMTM), Laboratoire de Mécanique des Solides CNRS, Ecole Polytechnique, Institut Polytechnique de Paris, all these researches being started 25 years ago in Romania and being among the first ones developed in Europe at that time.

The first paper within the series included in the current issue is a review paper, which summarizes some general aspects regarding Additive manufacturing as well as the challenges and perspectives of AM technologies.

The second paper entitled "Microstructure and process parameters for directed energy deposition Additive Manufacturing" presents the researches regarding the relationship between parameters of a Directed Energy Deposition process and the resulting microstructure and properties of the additively manufactured material. The results indicate that an optimization of the process parameters trigger the control of microstructure and consequently its macroscopic mechanical behavior.

The third paper entitled "Rapid product development using Additive Manufacturing technologies" presents research and case studies on the use of selective laser sintering (SLS) and selective laser melting (SLM) technologies in the development of new products and their applications in various fields, ranging from industry to medicine discusses the following topics: problems related to the materials

used in applications (metallic and non-metallic powders), properties of the products manufactured by SLS and SLM technologies, and optimization of the manufacturing parameters for obtaining controlled structures and properties.

The fourth paper entitled "Remanufacturing of parts using Additive Processes. Case studies" presents three case studies: how a damaged gear from a collection sewing machine is redesigned and remanufactured, using selective laser melting process, how are (re)manufactured human teeth using selective laser melting process and how a damaged gear from a fishing reel is redesigned and remanufactured using Polyjet technology.

The fifth paper entitled "The importance of support optimization for Additive Manufacturing process" describes why support optimization is a very important step in additive manufacturing process. Additive manufacturing process gains an important place in medical industry due to the ability to obtain complex geometries, lattice structures impossible to be achieved using conventional technologies. The support structures solve many problems such as: channeling the heat flux produced by the laser beam, and thus improving the cooling down of the structure during the fabrication process, they avoid detachment of parts from the baseplate during the job due to uneven contraction, and transfer the heat to it, but also introduces new challenges such as: how to remove of support structures, the optimization.

The sixth paper entitled "Design for Additive Manufacturing to produce complex metal parts" presents a practical example of how an existing industrial metallic component should be redesigned to exploit the benefits of selective laser melting (SLM) manufacturing. The main challenges are: the component design in order to avoid the support structures, which typically anchor the surfaces, and to develop a special shape for internal channels that does not need support structure, because they are difficult or impossible to remove at the end of SLM manufacturing. To test and validate the proposed method, the model was directly SLM processed from stainless steel (316L) powder. Combining principals of design for additive manufacturing and SLM process can be an efficient tool to obtain real industrial parts, while avoiding the support structures by integrating them into the surfaces. Respectively, ways of developing new concepts of holes for maintaining the same area of them as in the conventional approach was presented in the paper.

We strongly believe that this issue will be a valuable contribution to the field of Additive Manufacturing and a source for further development and scientific discussion within this still growing branch of manufacturing not only in Romania, but also in the World.

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