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Editors

Selected Topics in Manufacturing

AITeM Young Researcher Award 2021

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Preface

Europe is playing a major role in worldwide manufacturing and has a particularly good positioning in medium-high-tech products. Manufacturing accounts for 83% of European export and is therefore vital for the European economy. Italy is the second major player in European manufacturing after Germany. Recent crises, namely the financial crisis in 2008 and the pandemic crisis in 2019, have highlighted the importance of manufacturing as the backbone of European and Italian economies and have shown that manufacturing is extremely important to guarantee the resilience of a country. Manufacturing has also important social implications since, on the one hand, it provides occupation with average wages higher than the service sector and, on the other hand, can provide all the products for the society of the future both in normal and in critical times. Indeed, for example, manufacturing is the cornerstone to supply products needed to overcome health problems, as it has been recently appreciated in the pandemic crisis, and as another example, all the products required to fight environmental changes which is one of the most important challenges for the future of the planet. The main idea is that, when big problems are at stake, manufacturing can provide advanced and highly specialized products in big volumes to really make the difference. Therefore, manufacturing is the key to the future well-being in our societies.

In order to remain competitive, manufacturing requires continuous innovation to maintain technological leadership. Italy, as well as Europe, does not own significant natural resources, and is based on an advanced society which implies the centrality of safety at work, the well-being of the employees, strict regulation on environmental preservation and enhancement. Therefore, worldwide competition is particularly challenging and needs to be addressed with continuous technological improvement. Indeed, manufacturing is the sector with the highest growth rate in efficiency and industry 4.0 is just the last wave in this process. However, efficiency is not enough, and to guarantee leadership it is necessary to continuously innovate products, manufacturing processes and manufacturing systems. Indeed, the European ambition is to become the world's most competitive and dynamic knowledge-based economy.

In order to go in this direction, it is necessary that basic research and applied research work hand in hand in order to shorten the period to bring new ideas to potential application and to be more productive and imaginative. Also research and innovation need to be more and more connected, in order to guarantee fast exploitation of new solutions.

In this scenario, AITeM the Italian Manufacturing Association (Associazione Italiana delle Tecnologie Manifatturiere) has the role of connecting all the manufacturing professors and researchers belonging to the scientific sector "ING-IND/16 Manufacturing" (Tecnologie e sistemi di Lavorazione) and creating a continuous interaction with industry. With its 290 academic members, AITeM connects all the 38 Italian Universities dealing with manufacturing; also, by the same token, it gets access to a network of manufacturing labs that is by far the widest and more complete experimental structure related to manufacturing technologies and systems available in Italy. This network virtually encompasses all the new and conventional manufacturing technologies and manufacturing system applications. Since each researcher and each lab in the network is connected to many companies operating in the field both as technology providers and technology users, AITeM also represents the strongest Italian relation between manufacturing companies and academia. Finally, AITeM academic members teach all the courses on manufacturing in Italy getting access to and teaching all the cohorts of manufacturing students in Italy. These students represent the future of Italian manufacturing and guarantee a transfer "by head" to Italian and foreign companies of the new findings in manufacturing research and innovation.

The actions of AITeM are based on community building, to strengthen and continuously nurture the relations within the network described before, and interaction with industry, to guarantee a smooth and fast transition of new ideas to industry and to formally define new manufacturing problems on the basis of emerging industrial needs.

Regarding community building, AITeM organizes every other year a conference where all the Italian scientists participate to discuss the most recent findings in the area of manufacturing, and organizes other more focused conferences and workshops on specific topics of manufacturing science and technology. Also, it defines the strategy of evolution of the Italian sector ING-IND/16 with particular emphasis on the new generations of researchers and professors. Regarding the interaction with industry, AITeM has three main streams of action. The first one aims at offering short courses created for companies, where innovative manufacturing topics are presented both from a theoretical and a practical point of view. These courses are taught by AITeM members but also involve invited national and international scientists and company professionals. The second one supports talent scouting and breakthrough idea generation through an initiative called Manuthon®, which is the first hackathon devoted to manufacturing. It involves manufacturing students (bachelor, master and PhD) from all Italian universities to address a set of challenges proposed by companies. The third one is open innovation, where AITeM gives its scientific support to define open innovation challenges proposed by the big companies and provides the scientific support in screening solutions coming from startups and innovative SMEs.

All the described instruments are used by the AITeM "Sections" to foster the collaboration between companies and academia. Sections are communities of academic and industrial specialists dealing with a specific cutting-edge manufacturing topic, and each Section has an academic and an industrial chairperson. Within a Section, new courses are generated, Manuthon® challenges and open innovation challenges are identified, and new applications and new ideas are discussed in order to diminish the gap between idea generation and industrial applications. Sections have a predefined time frame and, at the end of their 2-year cycle, generate a white paper showing, among other things, the Italian state of play in the specific topic of the Section.

This book is one of the AITeM actions towards the development of science and its presentation to a wider public. It collects the best papers produced by young AITeM members in the area of manufacturing selected by the Editorial Committee and carefully reviewed. In particular, this year's edition contains contributions covering the areas of additive manufacturing, new processes for new materials, sustainability and circular economy, manufacturing systems design and operations. This book clearly shows the nature of AITeM's approach which is cross-sectoral, deals with the intimate relation between the technologies and the corresponding machines and manufacturing systems, and supports the creation of new manufacturing paradigms. The book provides a snapshot of the vitality of the Italian research community looking towards the future and a novel contribution to research and innovation.

Naples, Italy
Milan, Italy

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