Novel Industry 4.0 Technologies and Applications

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The Industry 4.0 paradigm has led to the creation of new opportunities for taking advantage of a series of diverse technologies in the manufacturing domain, including Internet of Things, Augmented and Virtual Reality, Machine Learning, Advanced Robotics, Additive Manufacturing, System and Process Simulation, Computer-Aided Design/Engineering/Manufacturing/Process Planning systems as well as Product Lifecycle Management platforms.

The integration of such technologies, employing information that is generated during different phases of a product lifecycle, may lead to the better utilization and optimization of existing resources, such as labor, materials, energy, and equipment, as well as to the development of products of higher quality and performance in a sustainable manner.

Considering the continuous growth of available computational power, the proliferation of cloud-based platforms, the cost-efficient development and utilization of once prohibitively expensive equipment, such as robotic systems (stationary, mobile, collaborative, and wearable), advanced sensors, and 3D printers, there will be a time when engineers will be able to transform the requirements pertaining to a new product to detailed production, supply chain, and product lifecycle management configurations in a very accurate manner, exploring diverse demand and production scenarios. Engineers would at some point be capable of identifying very fast, perhaps in a fully automated and intuitive way, what the product design would look like, which resources would be needed for developing the product and how they should be configured, who would be supplying parts, equipment, and services, how the product could be repaired and updated, and how it could be recycled when reaching its end of life.

Although products and manufacturing processes are typically quite complex and are often associated with a high degree of uncertainty, it is expected that the availability of more information will lead to the generation of structured product development knowledge and models, which will make their way in tightly integrated digital manufacturing platforms, thus enabling the faster and overall more efficient development of products and services.

However, the first demonstrations of Industry 4.0 principles and technologies are already here and will pave the way towards further developments in manufacturing. This book includes 13 papers that discuss how the Industry 4.0 paradigm may be applied in real engineering and manufacturing cases. The topics covered span a series of diverse areas related to: product design and development [1–3], manufacturing systems and operations [4–8], process engineering [9,10], and Industry 4.0 technologies review and realization [11–13].

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