Chapter 6
Virtual Laboratory to Face New Challenges in the Industry:
Virtual Laboratory as Part of the New Education Age

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ABSTRACT

The fast-growing field of technology allows for the development, design, and implementation of smart solutions to several industries such as smart grid, manufacturing, automotive, and robotics. Trends in smart solutions are based on providing a certain degree of intelligence to the process and products through intelligent artificial and machine learning algorithms. It also involves further use of devices based on power electronics elements, fast microcontrollers, intelligent algorithms, and processing of information via local or cloud. Hence, a new workforce that possesses multidisciplinary skills (i.e., dealing with different fields of knowledge in order to find solutions to complex problems) is required. Recently, virtual laboratories have emerged so as to aid in the improvement of forming engineers. In this chapter, a virtual co-simulation laboratory is proposed to deal with the lack of engineers with multidisciplinary skills in mind; additionally, a new framework based in co-simulation, co-modeling, and co-design is proposed in order to maximize the use of the laboratory proposed.

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INTRODUCTION

The recent inclusion and adoption of power electronics devices into several areas of the industries has enabled a fast production with high quality and low cost (van Wyk & Lee, 2013). The incorporation of these devices increases the functionality, security, reliability, efficiency, and interoperability of various process. Nowadays, the industries such as the smart-grid, manufacturing, automotive, and robotics have implemented and developed smart environments and smart devices in order to increase their functionalities and benefits (Quinn & Dalal, 2017). Smart-grid industry includes a high implementation of power electronics devices, and it promotes the interoperability between all stakeholders in the electrical grid. The modernization of power grids represents a reduction of global warming and greenhouse emissions. In order to achieve this renovation, the electrical industries require a workforce with multiple abilities and knowledge in several fields such as power electronics, automatic control, communication technologies, information technologies, public policy, algorithms to mention some (Shahidehpour, 2011; Steinbrink et al., 2017).

In the same direction, industrial advances combine production system planning, operation, and engineering with communication and information technologies (Colombo, Karnouskos, Shi, Yin, & Kaynak, 2016). The automatization in different industrial fields frequently is supported by industrial robots, which integrates the mechanized technology, electronic technology, material technology, and control technology in order to increase productivity in the industry (Yasuda, 2017). New production demands are related to manufacturing equipment, production line, and data acquisition. According to (Chen et al., 2018), the production objectives require a workforce with knowledge associated with the configurable controllers, self-configurable robots, data acquisition, communication protocols, and information algorithms. Similarly, the automotive industry has been dealing with different technical issues such as real-time data analysis, software, and hardware complexity, moreover non-technical issues like consumer preferences, and ethical concerns (Zhang, Zhang, Zhang, & Edmonds, 2016; Hussain & Zeadally, 2019).

Industrial problems and their solutions are moving towards the smart era which includes several fields of knowledge and requires a specialized workforce that posses multidisciplinary skills (Shahidehpour, 2011; Kurth, Schleyer, & Feuser, 2016; Potkonjak et al., 2016). The World Economic Forum presents the 10 skills which are recommended for the new workforce. Creativity, cognitive negotiation, coordination with others, and emotional intelligence are abilities which are added to the traditional abilities such as complex problems, critical thinking, people management, judgment and decision making, service orientation, and negotiation (World Economic Forum, 2018). In recent years, remote and virtual laboratories have been implemented in order to provide a real scenario to learn, practice, and