

Chapter 47

Industry 4.0 in Pumping Applications: Achievements and Trends

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ABSTRACT

This chapter addresses the so-called Industry 4.0 and some of its applications in industrial pumps, seeking to emphasize its characteristics and benefits. The introduction of 4.0 industry technologies in this traditional industry can cause profound changes in existing business models, providing greater customer satisfaction, either improving the effectiveness of equipment operation, contributing to better adjustment to working conditions, and also prolonging their life cycle. We are still in the early stages of these technologies and a lot is yet to evolve; however, there are already interesting examples developed by some pump manufacturers around the world, some of which will be mentioned in this chapter. It is subdivided into three main parts, namely brief historical panorama from the first industrial revolution to Industry 4.0, current applications in the industrial pump industry, and finally, future research directions and conclusion.

INTRODUCTION

The first Industrial Revolution arose about two hundred and fifty years ago and the industrial equipment production and application processes are in constant evolution: cost reduction, higher productivity rates, increased reliability and return on investment are constant drivers in the industry.

In this context Industry 4.0 comes up. It is characterized by the combination of various technologies that are gaining momentum today, such as the Internet of Things, Big Data, Cloud Computing, and the Integration of Physical and Cybernetic Systems, creating the so-called smart factories and businesses. Other technologies would be mentioned here such as artificial intelligence, advanced robotics, autonomous vehicles, 3D printing, nanotechnology, biotechnology, new forms of energy and energy storage,

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quantum computing, neurotechnologies, new materials, implantable and wearable technologies, connected houses, smart cities, bitcoins, blockchain and the shared economy (Schwab, 2015; Hermann, Pentek & Otto, 2015).

Two aspects distinguish Industry 4.0 from other previous revolutions: the speed, breadth, and depth of the transformations that will emerge from it; fusion of technologies and interaction between the physical, digital and biological domains (Schwab, 2015).

An important intention of such technologies is to decentralize production and allow decisions to be made in real time, based on accurate data or even autonomously by machines, according to the needs of each moment, bringing clear gains in productivity, material savings and reduction of maintenance costs, since the machines will have information to operate more efficiently and following demand fluctuations.

This is the main purpose of this chapter, i.e., to address the latest applications, advances and trends of Industry 4.0 in pumping fluids in various areas, such as process industry, water supply among others, exemplifying with case studies.

BACKGROUND

Industry 4.0: A Historical and Technological Perspective

Throughout history the technological advances have brought various benefits to mankind, among them, perhaps the most important is the labor transformation, which made it easier and more productive, through the use of devices, machines and equipments, from the simplest to the most complex, which made it possible to multiply human strength, perform tasks faster and more accurately, and harness energy sources to provide better living conditions.

Since prehistory, humans have developed artifacts to hunt better and, therefore, get more food which, together with the ability to generate fire and the use of the wheel, have provided relevant progress in that phase.

Therefore, in each historical moment, the human being develops technologies to solve the main problems of his time, but which also generate the effect of shaping social life and economic activities, thus presenting several developments that, over the centuries, have made possible the human evolution.

Regarding specifically the energy transitions, as an example, relating to what was mentioned, Smil (2010) shows that they do not occur through sudden revolutionary advances, which follow long periods of stagnation, but, on the contrary, they evolve continuously from processes that alter the composition of the sources used to generate movement, heat and light.

On the other hand, some technological advances have been striking enough to profoundly transform the world in the moments in which they've occurred. Steam machine, mass production, the parallel development of electricity and the use of petroleum as an energy source, the emergence of digital technologies and automation marked, respectively the first, second and third industrial revolutions.

Klaus Schwab, founder and president of the World Economic Forum, ratifying what was mentioned, says there are four distinct periods of industrial revolution throughout history, including the phase that is just beginning. Schwab (2015) describes an industrial revolution as the emergence of new technologies and new ways of perceiving the world that bring about profound changes in economic and social structures. For the author, the speed, breadth and depth of this revolution will force us to rethink how countries develop, how organizations create value, and what it means to be human being.

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