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Ergonomics in the Industry 4.0: Collaborative Robots

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Editorial

Industry 4.0 is the emerging technological environment that encompasses the changes that occur in production processes and are related to the way in which elements and systems interact in the industry. Key concepts appear, such as Internet of Things, Cyber-Physical Systems, Big Data, Autonomous and Collaborative Robots, among others. This new paradigm, which is nothing more than a natural evolution of industrial technological development, gives rise to new forms of interaction of people with machines and artificial systems. Therefore, new ergonomic aspects appear to be analyzed at this juncture.

Collaborative Robotics deals with aspects related to the way robots work by sharing tasks with people. Traditionally, robots have worked in isolated cells carrying out welding, painting, machining or manipulation tasks, in order to be able to do it safely in relation to people, due to the danger of their rapid movement. In this sense, the collaborative robots are equipped with sensors and mechanisms that provide safe collision avoidance with people who share the same work environment or can react in case of collision minimizing possible damage. The use of a collaborative robot allows reducing the workload and fatigue of people relegating the robot in a shared task those efforts, gestures and movements that for the person may be harmful, or that cannot be performed with the precision and/or effectiveness required.

The use of the collaborative robot to assist people in tasks where physical effort is necessary for the handling of heavy loads is being very useful to predict and minimize the work-related musculoskeletal disorders. The robot works as an assistant near the person and this entails to contemplate a multitude of safety considerations [1]. In these tasks, robot and person are working collaboratively sharing the task so that the robot transports the load keeping it floating and the person guides the load with very little effort. The robot assists the person not only minimizing efforts but also establishing prohibited zones or facilitating the appropriate trajectories to perform the task efficiently [2].

When robot and person work sharing a load, a new, more complex human-robot system is formed, where human factors have a great weight in the system and new methodologies appears that contemplate them [3]. Modeling and simulation software of the human body is used to predict the interaction efforts that appear between human and robot, given the complexity of the kinematics of the human body. On the other hand, to quantify the efforts and the risk of damage over the person, ergonomic indicators are used [4], oriented on the one hand to restrict the task in relation to the measurement of efforts and movements on the joints; and on the other hand oriented to the task, which quantify the ability to perform certain actions comfortably. Another measure used in the human-robot collaboration is the confidence of the person towards the robot that determines the degree of autonomy of the robots, their efficiency and workload [5,6].

Although robotics and human-machine interaction are disciplines with a deep literature, the complexity of human behavior opens new doors for research that allow creating new paradigms.

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