A skill-based approach towards hybrid assembly

Efficient cooperation of humans and industrial robots is based on a common understanding of the task as well as the perception and understanding of the partner's action in the next step. In this article, a hybrid assembly station is presented, in which an industrial robot can learn new tasks from worker instructions. The learned task is performed by both the robot and the human worker together in a shared workspace. This workspace is monitored using multi-sensory perception for detecting persons as well as objects. The environmental data are processed within the collision avoidance module to provide safety for persons and equipment. The real-time capable software architecture and the orchestration of the involved modules using a knowledge-based system controller is presented. Finally, the functionality is demonstrated within an experimental cell in a real-world production scenario.