The industrial robot is more precisely an “automatically controlled, reprogrammable, multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or mobile” (ISO 8373:2012). According to the International Federation of Robotics, by 2018, more than 400,000 new units were being installed annually, and the global average robot density in the manufacturing industry was 99 robots per 10,000 employees. More than 30% of all installed robots were in the automotive industry, the biggest customer for robots.

Research on measuring and calibrating, modeling, programming and controlling, and integrating systems has been conducted to give robotic manipulators a wider variety of industrial applications. This special issue covers technical and academic efforts related to new technologies that improve the accuracy and facilitate the implementation of robotic manipulators in industrial applications.

The first paper, by Ibaraki et al., outlines technical issues and future research directions for the implementation of model-based numerical compensation schemes for industrial robots. The random forest method is used by Kato et al. to construct a calibration model for positioning errors and identify industrial robots’ positioning errors. A procedure for the quasi-static compliance calibration of serial articulated industrial manipulators is proposed by Theissen et al. A review of the kinematic modeling theory and a derived algorithm to identify error sources for a six-axis industrial robot are presented by Alam et al. Nagao et al. derive a forward kinematics model and identify the kinematics parameters for the calibration of a robot-type machine tool. A novel trajectory generation algorithm, including a corner smoothing method for high-speed and high-accuracy machining by industrial robots, is proposed by Tajima et al. Sato et al. study the vibration characteristics of an industrial robot and derive a mathematical model that represents the dynamic behavior of the system. In the context of smart manufacturing,
a multilayer quality inspection framework including a measurement instrument and a robot manipulator is introduced by Azamfirei et al. To support mass customization and the development of reconfigurable manufacturing systems, Inoue et al. propose an autonomous mobile robotic manipulator. Yonemoto and Suwa present an adaptive manipulation procedure to establish an automated scheduling technique that flexibly responds to unforeseen events, such as machine failures. Sasatake et al. introduce a learning system that is based on a method for calculating the similarity between tools, and they test it on a robot system for doing housework. Finally, for better knowledge of the key challenges that manufacturers experience in implementing collaborative industrial robots, an industrial survey is conducted by Andersson et al.

The editors sincerely appreciate the contributions of all the authors as well as the work of the reviewers. We are confident that this special issue will further encourage research and engineering work to increase our understanding and knowledge of robotic manipulators and their industrial applications.