SMART END-EFECTORS FOR PRODUCTION SYSTEMS

Radim Blecha, Petr Blecha, František Bradáč, Zdeněk Kolíbal*

The field of adaptable end-effectors has been under long-term study at the Institute of Production Machines, Systems and Robotics in Brno. The practice has shown that in order to improve the adaptability of industrial robots, it is especially necessary to apply the elements of active robot adaptability. This fact has lead to the development of smart end-effector for screwing assembly operations, which is also able to handle circular components. Within the above-mentioned institute, this problem is in the centre of attention of the Research Centre of Automatic Manipulation in Brno, a detached workplace of the Research Centre of Manufacturing Technology, Czech Technical University in Prague, project supported by the Ministry of Education, Youth and Sports of the Czech Republic. This contribution describes the development of smart end-effectors for assembly operations with application of the system analysis and risk analysis. The result are two smart end-effectors with multi-sensory system and built-in microprocessor that enables, apart from other things, identification of the end-effector, safe communication with the control system, filtration, pre-processing and analysis of the data obtained from sensors.

Key words: *robot, end-effector, system approach, MQD, distributed control system*

1. Introduction

In the framework of RCMT, the Institute of Production Machines, Systems and Robotics (IPMSR) of the Faculty of Mechanical Engineering, Brno University of Technology worked on the project 'Automatic manipulation in technological workplaces and production systems'. The aim of the project was to design, activate and run a self-acting modular production system formed by technological workplace with integrated discrete assembly station. The production system has been constructed in the heavy-machinery laboratory C1 of the IPMSR, with the final configuration as shown in Fig. 1. The adaptability of the industrial robot was solved with application of the system approach [1, 4, 6] and risk analysis according to Meta-Quality Deployment (MQD) method. This method has been created on the basis of an analysis of the factors influencing the construction process and of the quality assurance methods Quality Function Deployment (QFD), Fault Tree Analysis (FTA) and Failure Mode and Effect Analysis (FMEA) [1]. After the year 2000, the method was updated according to the requirements of ISO 9000:2000 series. Besides the system and process approach [8] it now also incorporates the principles of scientific design, quality assurance and is in accordance with the current legislation.

Fig. 1 shows the realized production system with lathe-turning centre SPM 16 CNC (1), milling machine PORThOS (2), industrial robot ABB IRB 4400/60 with travel (3), place for end-effector change (4) and transfer dock (5) for mobile robot VUTBOT-2 (6).

* Ing. R. Blecha, Ing. P. Blecha, Ph.D., Ing. F. Bradáč, Ph.D., prof. Ing. Z. Kolíbal, CSc., Brno University of Technology, Faculty of Mechanical Engineering, Institute of Production Machines, Systems and Robotics, Research Centre of Automatic Manipulation, Technická 2, 616 69 Brno, Czech Republic