Chapter 9
Standards and safety in robotics

In this chapter we shall briefly consider three basic European robotic standards. The first document ISO 9946 presents the characteristics of industrial robot manipulators. The second standard ISO 9787 is entitled Coordinate Systems and Motions. The most important and most extensive is the ISO 9283 standard which describes the performance criteria and the methods for testing of industrial robot manipulators.

The first standard requires from the robot manufacturers to clearly specify the characteristics and application requests for their industrial robots. First, the main type of application should be indicated. The standard enumerates the following areas of application: material handling, assembly, spot welding, arc welding, machining, spray painting and coating, application of adhesive, tool manipulation and work inspection or verification.

In continuation the manufacturer is required to indicate the external power sources, which in robotics are electrical, hydraulic, pneumatic and combined actuators. The maximum power consumption must be also referred to. A schematic drawing of the robot mechanical structure must be presented:

- Cartesian robot (Figure 9.1)
- Cylindrical robot (Figure 9.2)
- Polar (spherical) robot (Figure 9.3)
- Anthropomorphic robot (Figure 9.4)
- SCARA robot (Figure 9.5)

In all drawings the degrees of freedom of the robot mechanism must be marked and clearly visible. The drawing must include also the base coordinate frame and the mechanical interface frame which are determined by the manufacturer and specified by the second standard.

Of special importance is the diagram showing the boundaries of the workspace (Figure 9.6). The maximal reach of the robot arm must be clearly shown in at least two planes. The range of motion for each robot axis (degree of freedom) must be indicated. The manufacturer must specify also the center of the workspace $c_w$, where most of the robot activities take place.
The robot data must be accompanied by the characteristic loading parameters, such as mass \((kg)\), torque \((Nm)\), moment of inertia \((kgm^2)\) and thrust \((N)\). The maximal velocity must be given at a constant rate, when there is no acceleration or deceleration. The maximal velocities for particular robot axes must be given with