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Robotics — Vocabulary

Robotique — Vocabulaire

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 299, *Robotics*.

This third edition cancels and replaces the second edition (ISO 8373:2012), which has been technically revised.

The main changes to the previous edition are as follows:

— definitions have been reviewed to take into account the state of the art;

— entries have been added, e.g. medical robot, wearable robot and terms related to modularity;

— terms and definitions have been updated for harmonization with existing standards.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document provides a vocabulary of terms and related definitions for use in ISO documents relating to robotics. It supports the development of new documents and the harmonization of existing International Standards. Future amendments might be published in order to harmonize with ISO/TC 299 documents currently under development.

Robotics — Vocabulary

1 Scope

This document defines terms used in relation to robotics.

2 Normative references

There are no normative references in this document.

3 Terms and definitions — General

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
robot
programmed actuated mechanism with a degree of *autonomy* (3.2) to perform locomotion, manipulation or positioning

Note 1 to entry: A robot includes the *control system* (3.4).

Note 2 to entry: Examples of mechanical structure of robots are *manipulator* (4.14), *mobile platform* (4.16) and *wearable robot* (4.17).

3.2
autonomy
ability to perform intended tasks based on current state and sensing, without human intervention

Note 1 to entry: For a particular application, degree of autonomy can be evaluated according to the quality of decision-making and independence from human. For example, metrics for degree of autonomy exists for medical electrical equipment in IEC/TR 60601-4-1.

3.3
robotic technology
practical application knowledge commonly used in the design of robots or their control systems, especially to raise their degree of *autonomy* (3.2)

EXAMPLE Perception, reasoning and planning algorithms.

3.4
control system
robot controller
set of hardware and software components implementing logic and power control, and other functions which allow monitoring and controlling of the behaviour of a *robot* (3.1) and its interaction and communication with other objects and humans in the environment

3.5
robotic device
mechanism developed with *robotic technology* (3.3), but not fulfilling all characteristics of a *robot* (3.1)

EXAMPLE Teleoperated remote manipulator, haptic device, end-effector, unpowered exoskeleton.

3.6
industrial robot
automatically controlled, reprogrammable multipurpose *manipulator* (4.14), programmable in three or more axes, which can be either fixed in place or fixed to a *mobile platform* (4.16) for use in automation applications in an industrial environment

Note 1 to entry: The industrial robot includes:

— the manipulator, including *robot actuators* (4.1) controlled by the robot controller;

— the robot controller;

— the means by which to teach and/or program the robot, including any communications interface (hardware and software).

Note 2 to entry: Industrial robots include any auxiliary axes that are integrated into the kinematic solution.

Note 3 to entry: Industrial robots include the manipulating portion(s) of mobile robots, where a mobile robot consists of a mobile platform with an integrated manipulator or robot.

3.7
service robot
robot (3.1) in personal use or professional use that performs useful tasks for humans or equipment

Note 1 to entry: Tasks in personal use include handling or serving of items, transportation, physical support, providing guidance or information, grooming, cooking and food handling, and cleaning.

Note 2 to entry: Tasks in professional use include inspection, surveillance, handling of items, person transportation, providing guidance or information, cooking and food handling, and cleaning.

3.8
medical robot
robot (3.1) intended to be used as medical electrical equipment or medical electrical systems

Note 1 to entry: A medical robot is not regarded as an *industrial robot* (3.6) or a *service robot* (3.7).

3.9
industrial robot system
robot system
machine comprising an *industrial robot* (3.6); *end-effector(s)* (4.12); any end-effector sensors and equipment (e.g. vision systems, adhesive dispensing, weld controller) needed to support the intended task; and a task program

Note 1 to entry: The robot system requirements, including those for controlling hazards, are contained in ISO 10218-2.

3.10
robotics
science and practice of designing, manufacturing, and applying *robots* (3.1)

3.11
operator
person designated to start, monitor and stop the intended operation

3.12
task programmer
person designated to prepare the *task program* (6.1)

3.13
collaboration
operation by purposely designed *robots* (3.1) and person working within the same space

3.14
robot cooperation
information and action exchanges between multiple *robots* (3.1) to ensure that their motions work effectively together to accomplish the task

3.15
human–robot interaction
HRI
information and action exchanges between human and *robot* (3.1) to perform a task by means of a *user interface* (6.18)

EXAMPLE Exchanges through vocal, visual and tactile means.

Note 1 to entry: Because of possible confusion, it is advisable not to use the abbreviated term "HRI" for human–robot interface when describing user interface.

3.16
validation
confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled

[SOURCE: ISO 9000:2015, 3.8.13, modified — definition modified and notes to entry removed.]

3.17
verification
confirmation by examination and provision of objective evidence that the requirements have been fulfilled

[SOURCE: ISO 9000:2015, 3.8.12, modified — definition modified and notes to entry removed.]

4 Terms related to mechanical structure

4.1
actuator
robot actuator
power mechanism that converts electrical, hydraulic, pneumatic or any energy to effect motion of the robot

4.2
robotic arm
arm
primary axes
interconnected set of *links* (4.7) and powered joints of the *manipulator* (4.14), between the *base* (4.9) and the *wrist* (4.3)

4.3
robotic wrist
wrist
secondary axes
interconnected set of *links* (4.7) and powered *joints* (4.8) of the *manipulator* (4.14) between the *arm* (4.2) and *end-effector* (4.12) which supports, positions and orients the end-effector

4.4
robotic leg
leg
mechanism of interconnected set of *links* (4.7) and *joints* (4.8) which is actuated to support and propel the *mobile robot* (4.15) by making reciprocating motion and intermittent contact with the *travel surface* (8.7)

4.5
configuration
<kinematics> set of all *joint* (4.8) values that completely determines the shape of the *robot* (3.1) at any time

4.6
configuration
<modularity> arrangement of the *modules* (9.3) to achieve the desired functionality of a *robot* (3.1)

4.7
link
rigid body connected to one or more rigid bodies by *joints* (4.8)

4.8
joint
mechanical part that connects two rigid bodies and enables constrained relative motion between them

Note 1 to entry: A joint is either active/powered or passive/unpowered.

4.8.1
prismatic joint
sliding joint
assembly between two *links* (4.7) which enables one to have a linear motion relative to the other

4.8.2
rotary joint
revolute joint
assembly connecting two *links* (4.7) which enables one to rotate relative to the other about a fixed *axis* (5.3)

4.9
base
structure to which the first *link* (4.7) of the *manipulator* (4.14) is attached

4.10
base mounting surface
connection surface of the first *link* (4.7) of the *manipulator* (4.14) that is connected to the *base* (4.9)

4.11
mechanical interface
mounting surface at the end of the *manipulator* (4.14) to which the *end-effector* (4.12) is attached

Note 1 to entry: See ISO 9409-1 and ISO 9409-2.

4.12
end-effector
device specifically designed for attachment to the *mechanical interface* (4.11) to enable the *robot* (3.1) to perform its task

EXAMPLE *Gripper* (4.13), welding gun, spray gun.

4.13
gripper
end-effector (4.12) designed for seizing and holding

4.14
manipulator
mechanism consisting of an arrangement of segments, jointed or sliding relative to one another

Note 1 to entry: A manipulator includes robot actuators.

Note 2 to entry: A manipulator does not include an *end-effector* (4.12).

Note 3 to entry: A manipulator typically consists of the *arm* (4.2) and the *wrist* (4.3).

4.14.1
rectangular robot
Cartesian robot
manipulator (4.14) which has three *prismatic joints* (4.8.1), whose *axes* (5.3) form a Cartesian coordinate system

EXAMPLE Gantry robot (see Figure A.1)

4.14.2
cylindrical robot
manipulator (4.14) which has at least one *rotary joint* (4.8.2) and at least one *prismatic joint* (4.8.1), whose *axes* (5.3) form a cylindrical coordinate system

Note 1 to entry: See Figure A.2.

4.14.3
polar robot
spherical robot
manipulator (4.14) which has two *rotary joints* (4.8.2) and one *prismatic joint* (4.8.1), whose *axes* (5.3) form a polar coordinate system

Note 1 to entry: See Figure A.3.

4.14.4
pendular robot
manipulator (4.14) whose mechanical structure includes a universal joint pivoting subassembly

Note 1 to entry: See Figure A.4.

4.14.5
articulated robot
manipulator (4.14) which has three or more *rotary joints* (4.8.2)

Note 1 to entry: See Figure A.5.

4.14.6
SCARA robot
manipulator (4.14) which has two parallel *rotary joints* (4.8.2) to provide *compliance* (6.12) in a selected plane

Note 1 to entry: SCARA is derived from selectively compliant arm for robotic assembly.

4.14.7
parallel robot
parallel link robot
manipulator (4.14) whose *arms* (4.2) have *links* (4.7) which form a closed loop structure

EXAMPLE Stewart platform.

4.15
mobile robot
robot (3.1) able to travel under its own control

Note 1 to entry: A mobile robot can be a *mobile platform* (4.16) with or without *manipulators* (4.14).

Note 2 to entry: In addition to autonomous operation, a mobile robot can have means to be remotely controlled.

4.15.1
wheeled robot
mobile robot (4.15) that travels using wheels

Note 1 to entry: See Figure A.6.

4.15.2
legged robot
mobile robot (4.15) that travels using one or more *legs* (4.4)

Note 1 to entry: See Figure A.7.

4.15.3
biped robot
legged robot (4.15.2) that travels using two *legs* (4.4)

Note 1 to entry: See Figure A.8.

4.15.4
crawler robot
tracked robot
mobile robot (4.15) that travels on tracks

Note 1 to entry: See Figure A.9.

4.15.5
humanoid robot
robot (3.1) with body, head and limbs, looking and moving like a human

Note 1 to entry: See Figure A.8.

4.16
mobile platform
assembly of the components which enables locomotion

Note 1 to entry: A mobile platform can include a chassis which can be used to support a *load* (7.2).

Note 2 to entry: A mobile platform can provide the structure by which to affix a *manipulator* (4.14).

Note 3 to entry: Mobile platform following a predetermined *path* (5.5.4) indicated by markers or external guidance commands, typically used for logistic tasks in industrial automation is also referred to as Automated Guided Vehicle (AGV) or Driverless Industrial Truck. Standards for such vehicles are developed by ISO/TC 110.

4.17
wearable robot
robot (3.1) that is attached to and carried by the human during use and provides an assistive force for supplementation or augmentation of personal capabilities

5 Terms related to geometry and kinematics

5.1
forward kinematics
mathematical determination of the relationship between the coordinate systems of two parts of a mechanical linkage, based on the joint values of this linkage

Note 1 to entry: For a *manipulator* (4.14), it is usually the relationship between the *tool coordinate system* (5.11) and the *base coordinate system* (5.8) that is determined.