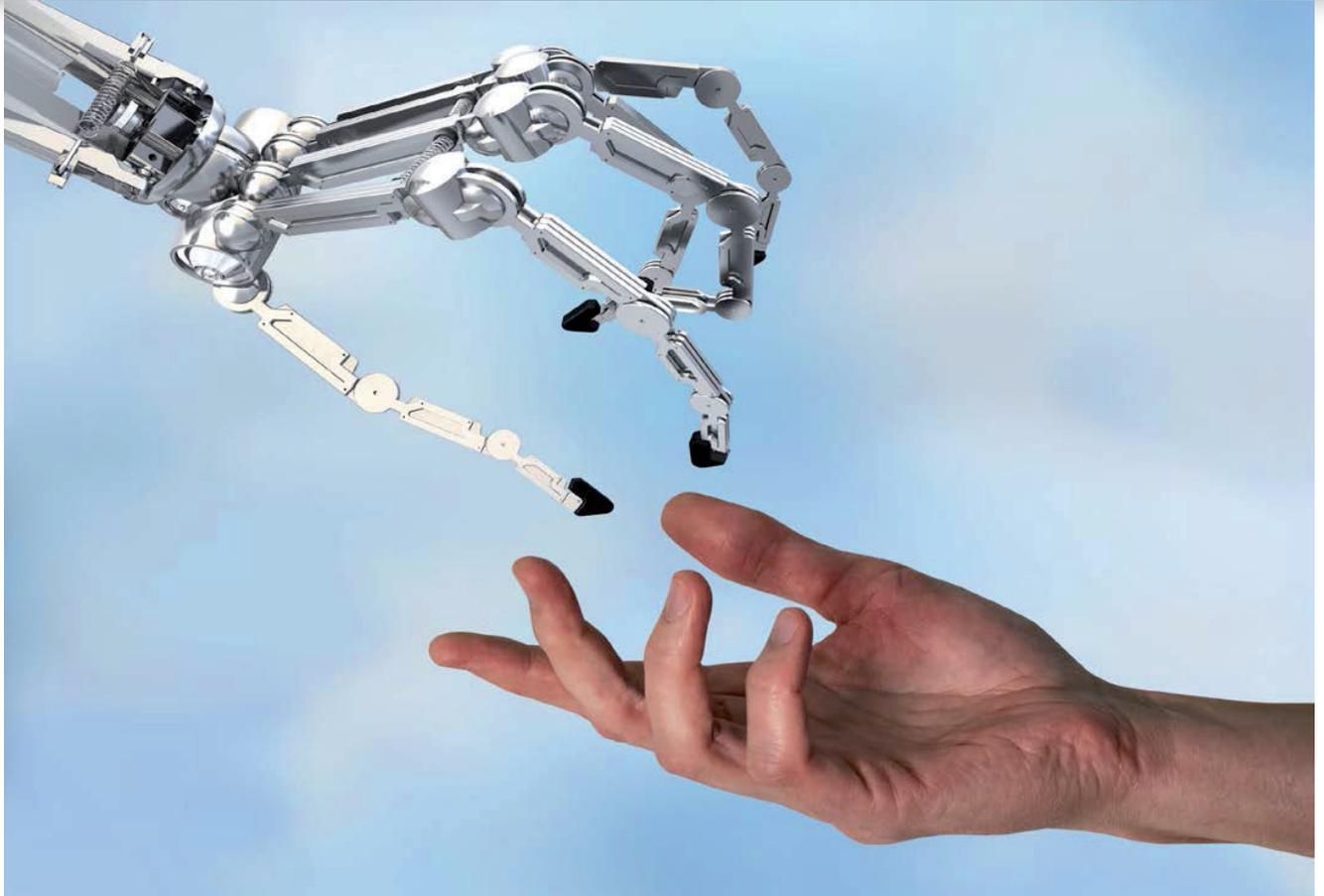


Collaborative Robots

Introduction



Safe Applications

- Description
- Definitions
- Guidelines
- Design

Description

The safety standard defines **collaborative robot** as a robot designed for direct interaction with a human within a defined collaborative workspace.

Identifiable design features may include:

- Compact and lightweight frame
- Round, soft edges
- Concealed cabling and tooling controls
- No pinch points
- Minimal openings and blind holes

Built in features may include:

- 7-degree of freedom manipulator
- Force sensing
- Compliant mode
- Low inertia servo motors
- Elastic actuators
- Collision detection
- Use of second encoder
- Safety-rated axis limits

These features alone are not enough to ensure an operator working next to them will be safe; it also requires considering the hazards identified by the risk assessment and correct application.

Information can be found in the Industrial Robots and Robot Systems – Safety Requirements standard, ANSI RIA15.06 -2012, which is harmonized with ISO 10218-1:2011 and ISO 10218-2:2011 .

Detailed collaborative safety requirements will be available in the ISO/TS 15066 Technical Specification, which is expected to be available in late 2015 or early 2016.

Definitions

Collaborative Workspace

ISO 10218 / ANSI RIA 15.06

Workspace within the safeguarded space where the robot and human can perform tasks simultaneously during production operation.

TS 15066

Space within the operating space where the robot system and a human can perform tasks concurrently during production operation.

The technical specification definition includes the robot system, which includes the work-piece, end-effector, fixtures and any device controlled by the robot.

Collaborative Operation

ISO 10218 / ANSI RIA 15.06

State in which purposely designed robots work in direct cooperation with a human within a defined workspace.

TS 15066

State in which a purposely designed robot system and an operator work within a collaborative workspace.

The technical specification clarifies the interaction between the operator and the robot system, with the shared space defined as the collaborative workspace.

Inherently Safe Design

ISO 12100

Measures taken to eliminate hazards and/or to reduce risks by changing the design or operating characteristics or product or system.

Intended Meaning

Operator

Any person who works on the machine (includes any person with the intention of exposure). The operator understands the robot's path and process. It does not include people who may interact with the machine on rare occasion such as management or tour groups.

New Terms in Technical Specification

Quasi-static Contact

When contact can cause body part to be clamped.

Transient Contact

When contact is not clamped, but can retract.

Industry Terms

Cobot

Collaborative Robot

HRI

Human Robot Interaction

Collaboration, cooperation

Same meaning

Collaborative Application

A collaborative application is when a robot designed for collaborative use works in close proximity to an operator(s) with power on and contact can occur.



A collaborative application can still have a safeguarded space and require protective measures.

Influential topics may include:

- space (workflow, obstacles)
- clearance around obstacles (building structures)
- accessibility
- foreseeable contact
- consequence of contact (include repetitive)
- other hazards associated with area (trips or falls)
- operator conditions (fatigue, stress)
- misuse
- training
- use limits
- transitions

Operators have to understand the robot's path and process.

Possible operator's reflex behavior based on an action by the robot:

- Winking from facial resembling screen
- Welding sparks
- Noise

Scope

Risk assessment is required.

The technical specification is not to be used in place of the current safety standard ISO 10218 / ANSI RIA 15.06.

A collaborative robot system still has to meet the requirements of ISO 10218 / ANSI RIA 15.06.

Safety related control system still has to meet the requirements of ISO 10218 / ANSI RIA 15.06.

While not listed in the technical specification, The PLd (Performance Level) rating for robots in the ISO 10218 / ANSI RIA 15.06 standard is also applicable for collaborative robot.

Since this is a new technology, calculations and values are expected to change in the future, especially for power and force limiting.

Collaborative robot applications installed prior to the technical specification publication do not need to be updated to meet this technical specification. Installations completed within the timeframe specified in the ISO 10218 / ANSI RIA 15.06 are expected to meet those requirements.

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