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Speed control for robots ROBOTICS IN INDUSTRIAL PRODUCTION

Virtual safety fences isolate robots from people. Cooperation between humans and robots without isolating safety fences is one of the hot topics in industrial automation. These kinds of cooperative working systems mean that the robots need an “in-built” safety fence, which shifts what were previously hardware functions to an intelligent controller.

For decades now, the golden rule in automated production has been that the working areas of people and robots are strictly separated and robots carry out their work behind safety fences. This rule is being broken in more and more companies, and for a good reason. When people and robots work together, both can contribute their own strengths - people have intelligence, judgement and flexibility, robots have power and untiring performance.

New roles for machine safety

The move from strict separation of the working areas to cooperative working systems requires intense preparatory work from both the robot manufacturers and from the system engineers and integrators. However, a distinction needs to be made between two roles here. For small robots moving at low speeds, tactile safety equipment is sometimes sufficient. But as robots are mostly used to relieve people of strenuous repeated

work, this is not normally adequate in most cases. Then the (virtual) safety fence needs to be shifted into the robot controller. This means: The robot monitors its own movements in the area and never leaves a defined working area.

These kinds of virtual safety fences are now used by many robot manufacturers. Leading providers rely on customer-specific solutions from the Schmersal Group, which has been carrying out research and development work in this area of machine safety for around fifteen years now. The result of this work is the “Safety Controller”. The so-called “Cartesian cams” are arranged so that they form a virtual working space. With the help of the safety controller, the robot then monitors its own position and the speed of the axles. If the forces and speeds are low enough, and all the robot axles are kept in a virtual “cage”, the robot can interact directly with the human. For example, it can hold a part while a person processes or inspects it. Or it feeds to the person the components that need to be processed.

From a safety technology perspective, this shifts what were previously hardware functions (safety fence) to software. In terms of human and robot cooperation, this kind of software-based safety system has the advantage that people can reach into defined areas of the safety zone. All the requirements of machine safety, e.g. immediate stoppage in the event of a hazardous situation, are met.

At the same time, the safety controller monitors the speed up to the threshold at all times. This means: The speed can only ever be so fast that the robot can brake at any time without leaving the movement zone allowed. By developing the Safety Controller, Schmersal has laid the foundations for one



Robot-supported plant systems are widespread in production and packaging. Their working area must be separated from that of the operator – usually by a safety fence. (Photo: ETT Verpackungstechnik)

of the safety strategies currently used by leading robot manufacturers and which is beginning to really make its mark in the automotive industry (and others). The relevant customer-specific safety controller allows the implementation of functions such as “safe axle zone” and “safe speed”.

Initially, the result of this is that electromechanical safety components are not required, and the hazardous area can be made smaller and the safety fence more streamlined. The safety fence only fulfils the function of preventing people entering the hazardous zone and protecting them from, for example, flying objects. The risk of the robot hitting the safety fence no longer needs to be taken into consideration.

From hardware to software.

At the same time, and this opens up the new opportunities mentioned at the beginning - the safe speed function allows direct cooperation between humans and robots at reduced working speed for the robot.

The safety controller is a good example of hardware functions increasingly being shifted to software, in machine safety too. Schmersal is pushing this development forward and will continue to reflect the principle of the virtual safety fence in future with new generations of safety controllers.

Application engineering for safe robotics

Safe human and robot cooperation is all about solutions which cannot be used 'off



For direct human to robot cooperation using virtual safety fences, the safety function are shifted to intelligent controllers. (Photo: Schmersal)

the peg', they need to be fundamentally adapted to the requirements of the user and integrated into the operational robot functions. These roles are covered by the “Application Engineering” division within the Schmersal Group. The engineers in this department, which is based at the Wuppertal and Wettenburg sites, develop individual software modules based on customer orders to enable optimum adaptation of the safety functions in the relevant application.

They can utilise experience from numerous customer-specific MRK applications based on the safety controller.

Images:

K.A. Schmersal GmbH & Co. KG, Wuppertal

Author:

K.A. Schmersal GmbH & Co. KG, Wuppertal

K. A. Schmersal GmbH & Co. KG

Mödinghofe 30

42279 Wuppertal

Telefon: +49 202 6474-0

info@schmersal.com

www.schmersal.com