KUKA Roboter GmbH (2006-05-30)

KUKA Roboter implements maximum safety - Safe Robot Technologie

KUKA Roboter, Europe's market leader and longstanding partner to the plastics industry, is unveiling a major innovation that will have a considerable effect on the way robots are used to boost industrial productivity: jointed-arm robots collaborating directly with human operators in a wide range of tasks, from materials handling and device tending to joining processes, component transfer and quality assurance tests. The new technology is called "KUKA Safe Robot". Its most important components are the functions "KUKA Safe Operation" and "KUKA Safe Handling".
KUKA Safe Operation dispenses with the need for mechanical axis range monitoring systems. The function monitors the velocity and acceleration of the axes and enables a safe operational stop of the robot. KUKA Safe Handling allows a worker to enter the robot's danger zone and guide the robot manually.
This is possible because, with the Safe Robot technology, the robot controller is now directly responsible for safety-relevant control tasks which, until now, have been the responsibility of an external safety PLC in the robotic cell. This means that in many applications – particularly in the context of manufacturing cells – light barriers, scanners or safety mats can be wired directly.

It is often possible to dispense with an additional safety PLC. This saves both procurement costs and regular maintenance costs.
Transferring the safety functions directly to the robot also increases the safety of the system. This is because with conventional, centralized safety systems, the reaction times in the case of a fault or safety-relevant event are essentially determined by the communication and cycle times of the PLC. Such solutions generally result in relatively slow reaction times and thus also relatively long robot braking distances. With KUKA's Safe Robot technology, by contrast, the reaction time is reduced, as every safety-relevant reaction is controlled directly by the safety module of the robot. This means that the robot braking distances can be significantly reduced, thus making it possible to place safeguards closer to the robot.

KUKA Safe Handling enables new system concepts
In addition to the economic benefits of the KUKA Safe Operation function, by eliminating expensive safety systems, the KUKA Safe Handling function is also highly significant, as it allows unprecedented new system concepts, particularly in the field of assembly systems. This technology can be used to combine the superior sensory capabilities of the human operator with the work output and enormous load-bearing capacity of the robot. Automation tasks which, until now, have not been economically viable can now be implemented using more cost-effective partial automation solutions. This means that the KUKA Safe Robot technology is opening up new possibilities for the plastics industry to implement customized solutions for every production task, ranging from purely manual – and thus cost-intensive – manufacturing, to highly complex full automation.

Safety systems allow human/machine cooperation

Until now, the state of the art was such that industrial robots could only be operated in safeguarded workspaces, without the possibility of humans entering this area with the robot in Automatic mode. The robots executed predefined motion and application programs. Reactions to changes in the production environment were carried out using digital signals from the higher-level PLC or via additional sensors.

The Safe Robot technology is based on a dual-channel monitoring system with built-in redundancy and cyclical testing of the brakes and the robot mastering.

The cyclical brake tests for each individual axis ensure their correct functioning at all times in the event of an emergency stop. The monitoring of the robot mastering ensures that the motion of the robot in space always corresponds to that calculated by the controller. The tests involve the robot moving cyclically to a reference position. The current axis positions are then compared with the saved reference positions, and loss of mastering in the event of a fault is detected immediately. The module responsible for monitoring the safety functions is designed using failsafe technology with built-in redundancy. Extensive test routines while the module is running up and during operation ensure that it is functioning correctly. Based on the reliably determined position values for each of the six robot axes, and optionally two external axes, the limit values of the ranges for individual axes and axis groups are monitored on the safety module, along with their velocity and acceleration. The safety-relevant parameters and limit values are configured directly in the robot controller.

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