

Focus on IFA's work

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Force/pressure measuring instrument for the assessment of collaborating robots

Problem

In industry, there are a growing number of workplaces at which people work very closely with robots. Human abilities and dexterity are being combined with the precise functions and power of the robot. This makes production more efficient and relieves the persons concerned of heavy labour. However, during such work processes collisions between humans and robots cannot be entirely ruled out, as the protective devices separating them have been eliminated. Protection from collisions must therefore be achieved by appropriately designing the workplace and the robot. Foreseeable (faulty) applications therefore have to be considered in risk assessment.

Activities

In cooperation with the German social accident insurance institution for the wood- and metal-working industries (BGHM), the Institute for Occupational Safety and Health of DGUV (IFA) has issued recommendations specifically for the biomechanical/medical stressing of humans in collisions. These contain limit values for the forces and pressures applied. If complied with, they prevent unacceptable physical strain. The robot system has to be equipped with safe controls and can thus reliably comply with the acceptable forces and pressures in operation. These recommendations have already been adopted in the ISO standard for industrial robots.



Robot applying force to the measuring instrument
(Source: MRK-Systeme GmbH)

The required risk assessment establishes whether collisions can occur during a work task with a collaborating robot. Critical collision processes then have to be measured and evaluated with reference to the limit values. A biofidelic, i.e. mechanically human-like, measuring instrument must be used for this. For industrial practice, IFA has developed the KDMG-KOLROBOT force/pressure measuring instrument which replicates the main biomechanical properties of the human body: deformability, inertial behaviour and motions of colliding body regions. The total forces arising on the colliding surface and local pressure maximums are measured, visualised and documented.

Results and Application

Two types of measuring instrument are available for flexible use in different collision environments for simulating the body and recording trapping/crushing and impact impulses. The dimensions of these measuring instruments are relatively small, so the instruments are easy to handle. They can be installed in a variety of ways and permit a wide range of practical applications. This is confirmed by ongoing tests and certifications of collaborating robots. With the aid of this measuring instrument, it is possible to acceptably limit the strain on the body in the rare event of a collision by suitably modifying the workplace or the parameters of the robot system, e.g. the axis speeds. There are plans to have the measuring system built and marketed under licence.

Area of Application

Test laboratories of the accident insurance institutions, manufacturers and operators of robot systems, and research establishments

Additional Information

- IFA technical information: Collaborating robots, www.dguv.de/webcode/e141826
- BG/BGIA risk assessment recommendations according to the Machinery Directive – Design of workplaces with collaborating robots, U 001/2009e (October 2009 edition, revised February 2011). Published by BGIA – Institut für Arbeitsschutz, Sankt Augustin 2009 www.dguv.de/publikationen, Order No. 10733 (free download)
- Ottersbach, H.-J.; Huelke, M.: Kollaborierende Roboter. Konzept und Realisierung eines biofidelen Messgeräts zur Begrenzung der Kollisionsbelastung auf Personen bei Arbeitsplätzen mit kollaborierenden Robotern. Technische Sicherheit 2 (2012) No. 10, pp. 14-19, www.dguv.de/webcode/m209505

Expert Assistance

IFA, Division 5: Accident prevention, Product safety

Literature Requests

IFA, Central Division