PhD4: Safety-related Design and Simulation of Cyber-Physical Production Systems

In this PhD topic methods for a computer-based, safety-oriented design based on simulations of cyber-physical-production-systems in discrete manufacturing and process industry are developed. In addition to the safety aspects, security risks will also be considered.

Motivation and Problem Statement

- Trend of Human-Robot Collaboration (HRC), with fenceless interactive robot arms (Cobots) [1]
- Potentials and advantages for production [2]
- New challenges for safety and security [3,4]
- Evaluation of impact forces and pressures for possible collisions
- Expensive and time-consuming biomechanical measurements [6]
- No standardized testing procedure [7]
- Simulation software offers high potential for HRC planning and analysis → Automatic safety assessment, e.g. check for compliance with biomechanical thresholds, not yet possible [8].

Objective: Development of a simulation model for the automated verification of the compliance of biomechanical thresholds of HRC.

Expected Results

- Requirements for the design and parametrization of cyber-physical-production-systems in development and test criteria for the acceptance of such systems
- Simulation model for the safe design of a HRC application

Research Question

“How can biomechanical thresholds and the resulting protection zones for cyber-physical systems be simulated or integrated into existing (process) simulations?”