A Joint Venture of TÜV Austria and TU Wien

Safety and Security in Industry Research Lab „SafeSecLab“

#SafeSecLab

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.

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- Studied mechanical engineering at the TU Wien
- Worked for the TU Wien Pilot factory

Interests

Robotics, Human-Machine Interaction, Biomedical Engineering

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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]
- ISO/TS 15066:2016 requires compliance of biomechanical thresholds in the event of a collision [5]
  - 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].

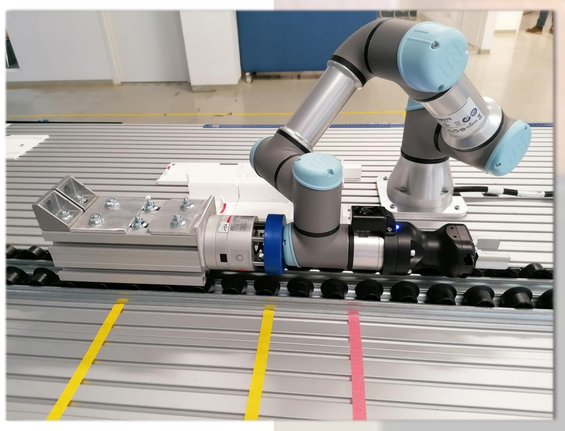
Research Question

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

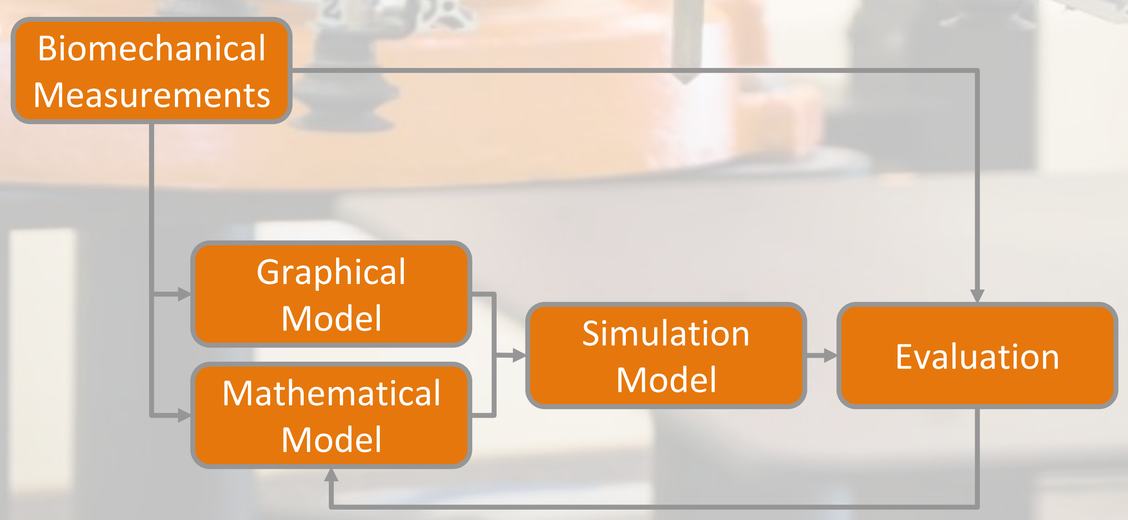
Picture by Michal Jarmoluk

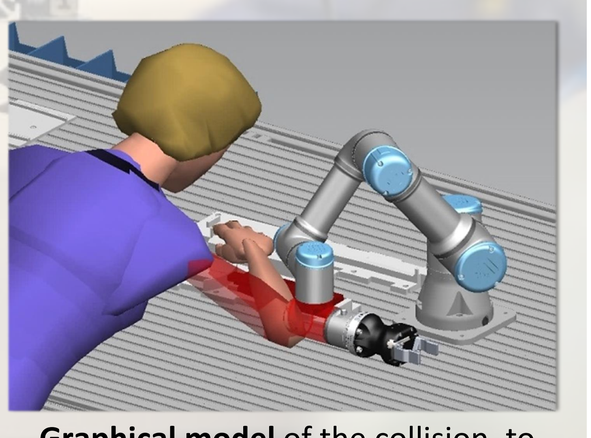
Project Goal and Methodology

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



Biomechanical measurement on HRC Use Case at TU Wien Pilot factory





Graphical model of the collision, to provide the impact data for the **mathematical model,** to calculate the collision force

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

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