

Robot Systems in Human Integrated Production

Fraunhofer Institute for Manufacturing Engineering and Automation IPA



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Fraunhofer IPA as part of the Fraunhofer-Gesellschaft



Fraunhofer Institute for Manufacturing Engineering and Automation IPA

- One of the largest institutes of the Fraunhofer-Gesellschaft
- IPA located in Stuttgart, the capital of federal state of Baden-Württemberg
- IPA: More than 1,000 employees, 74 M€ budget
- 60 years of experience implementing innovations for the industry
- Main customers are equipment/ machinery and automotive industry
- Startup-activities: 18



Typical Forms of Cooperation with Fraunhofer IPA

Bidirectional R&D Projects

- Specific R&D task, study, test, prototype
- Objective → offer → result/tech transfer
- Standard form of collaboration (>50%)



Strategic co-operations

- Longer term framework agreement
 - Strategic R&D (roadman), tech transfer
- Your R&D, pre-development pole



Why Fraunhofer?

- Neutrality
- Experience, competence, infrastructure
- Industrial mind-set, processes, quality



Examples of robot end-effector developments since 1973 (>150) at Fraunhofer IPA in Stuttgart

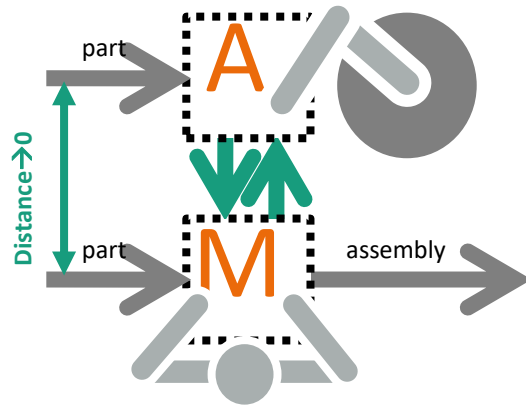


→ Exhibition Milestones of robotics at IPA

Why does Human-Robot-Collaboration catch on slowly?

The 4 benefit categories of HRC

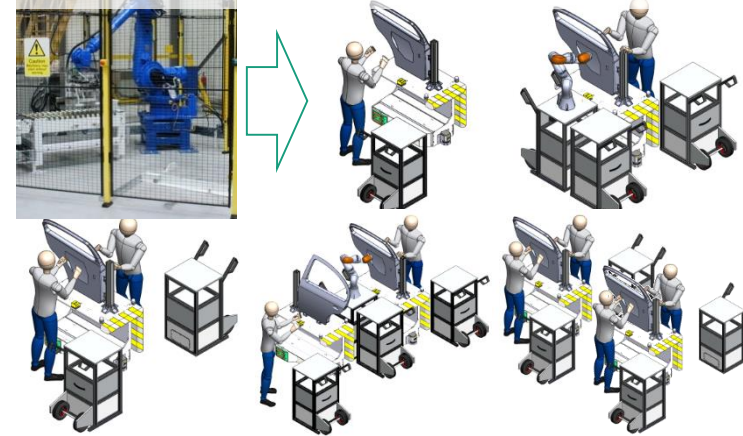
Distance ↓: less logistics, transfer



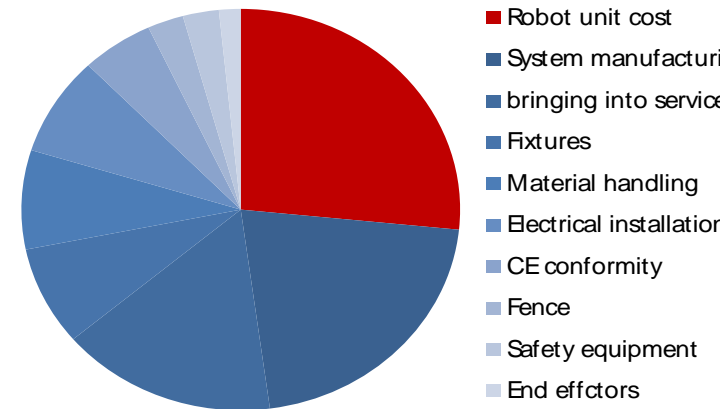
Ergonomics ↑: pairing strengths



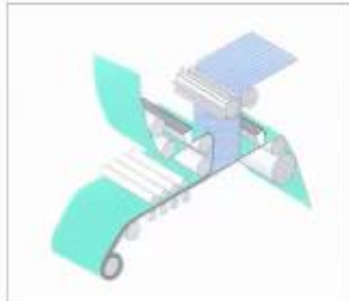
Agility ↑: safety fence elimination, mobility



Peripherals ↓: Integration into workplace



Fraunhofer E3 – Assistance Systems for Production



Assistance systems for production –
From manufacturing to assembly of a car hood

<https://www.youtube.com/watch?v=6giSUmKJ6io>

2x speed

Why does Human-Robot-Collaboration catch on slowly?

Planning for safety and certification as a burden

Guidelines and Procedures: ISO 12100

Robot and Robot Systems:

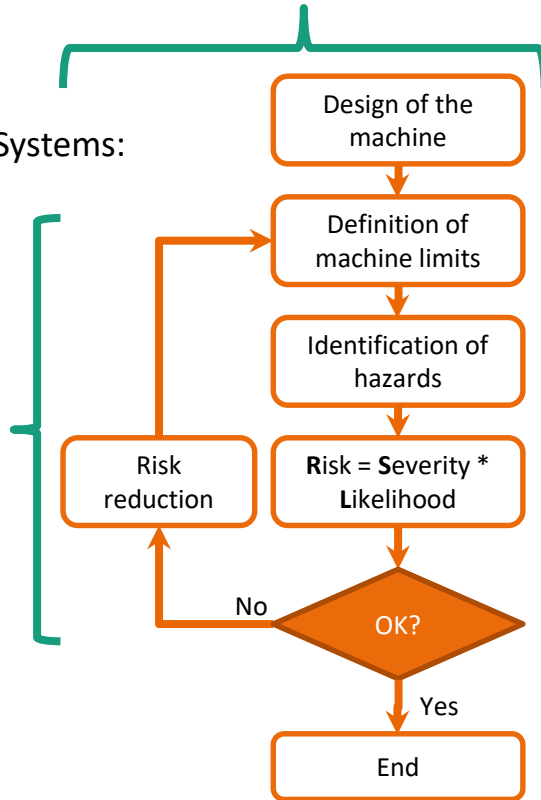
- ISO 10218-1
- ISO 10218-2

Control:

- ISO 13849
- IEC 62061

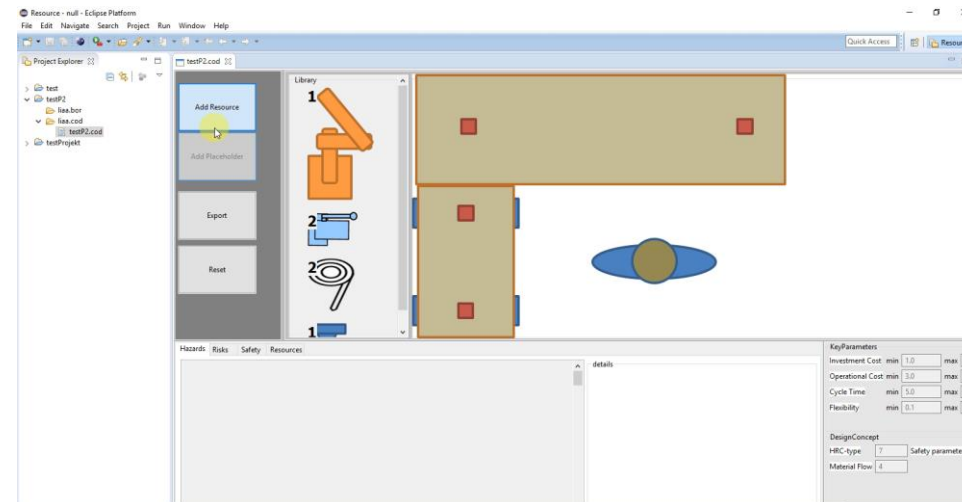
Safety Distances

- ISO 13855
- ISO 13857



Automated risk assessment and safety design; building blocks:

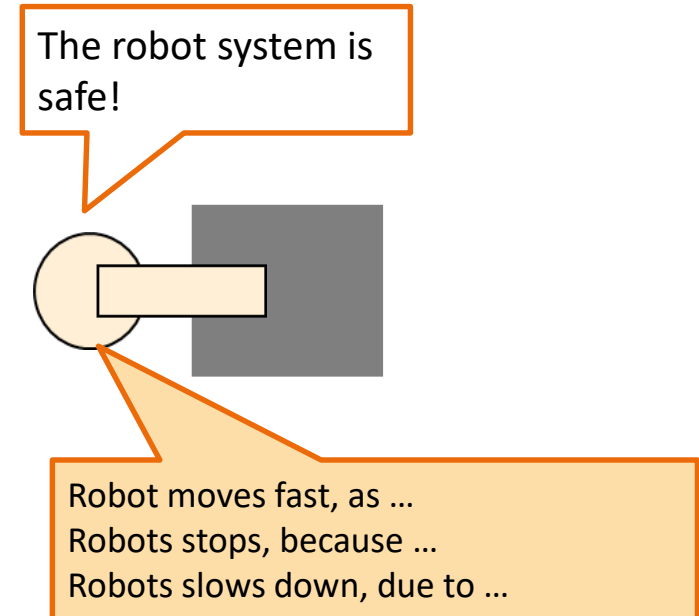
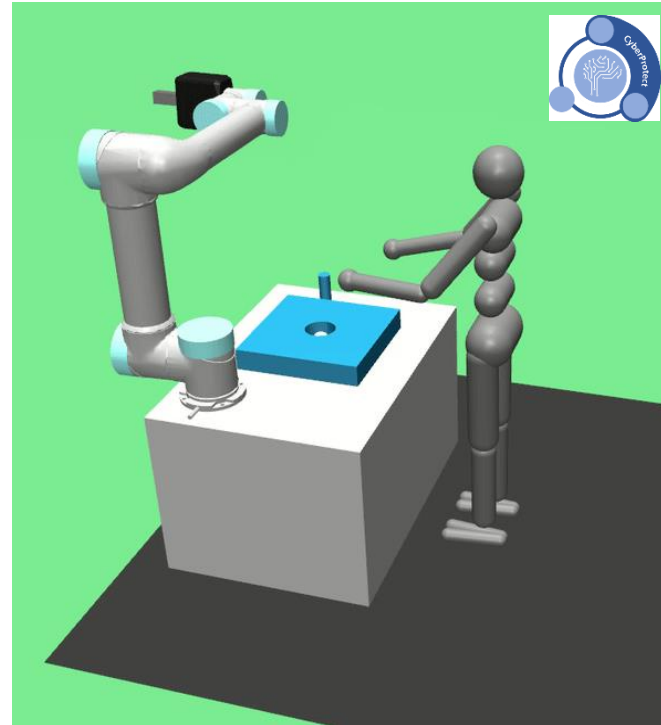
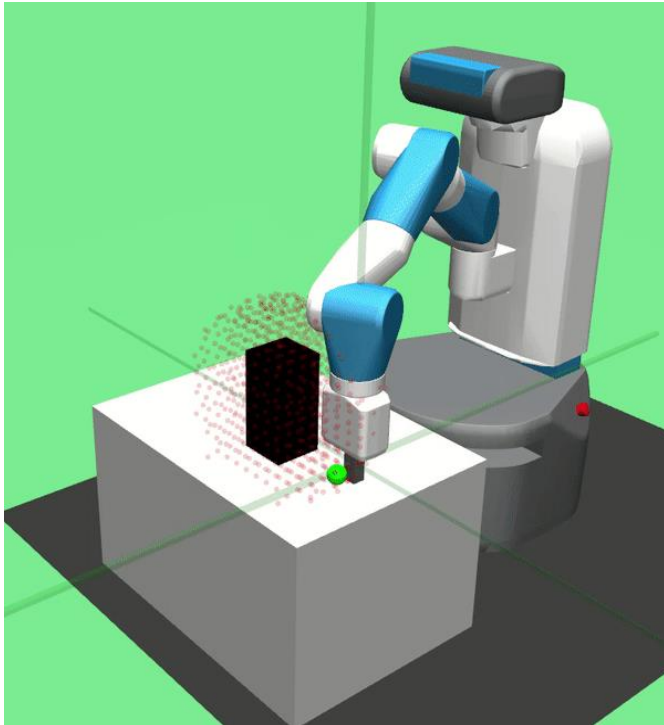
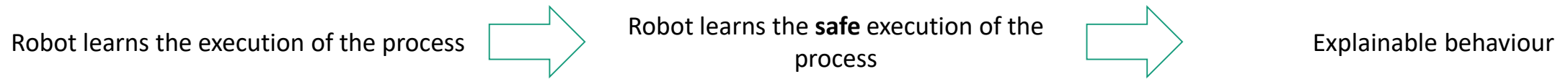
- Product (Parts, assemblies, etc.)
- Resources
- Processes (not yet fully implemented)
- Capabilities
- Hazards
- Safety Measures



Why does Human-Robot-Collaboration catch on slowly?

Outlook CARAML – Computer Aided Risk Assessment with Machine Learning

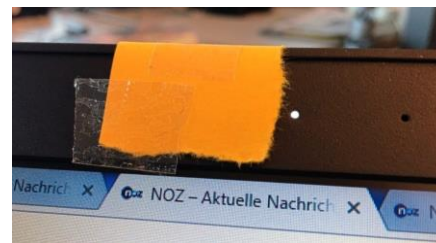
- Robot system learns the safe execution of assembly operations in simulation



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Conclusions

- The vision is clear: robot and human will work hand in hand together in future
- Personal safety according to machinery directive is a hard nut to crack → new safety systems (with safety integrity levels (SIL)) will appear
- Certification effort for each robot system limits the implementation of HRC → Computer aided risk assessment
- Besides safety, also security (e.g. manipulation) and privacy (e.g. data theft) become important



German television
Thriller Tatort 16.9.2018
Robot under suspicion of murder

