



ASSOLOMBARDA
Confindustria Milano Monza e Brianza

Robotica collaborativa

La risposta alle sfide dell'industria 4.0

Speaker

Andrea Zanchettin

6 luglio 2016

The MERLIN lab

MEchatronics and **RO**botics **L**aboratory for **IN**novation

Robotic available facilities

Robotic manipulators
Dual arm robot
Robot controllers
Haptic devices
Cameras

People

5 faculty members
5 PhD students
2 research grants assignees
12+ MSc students/year



Projects

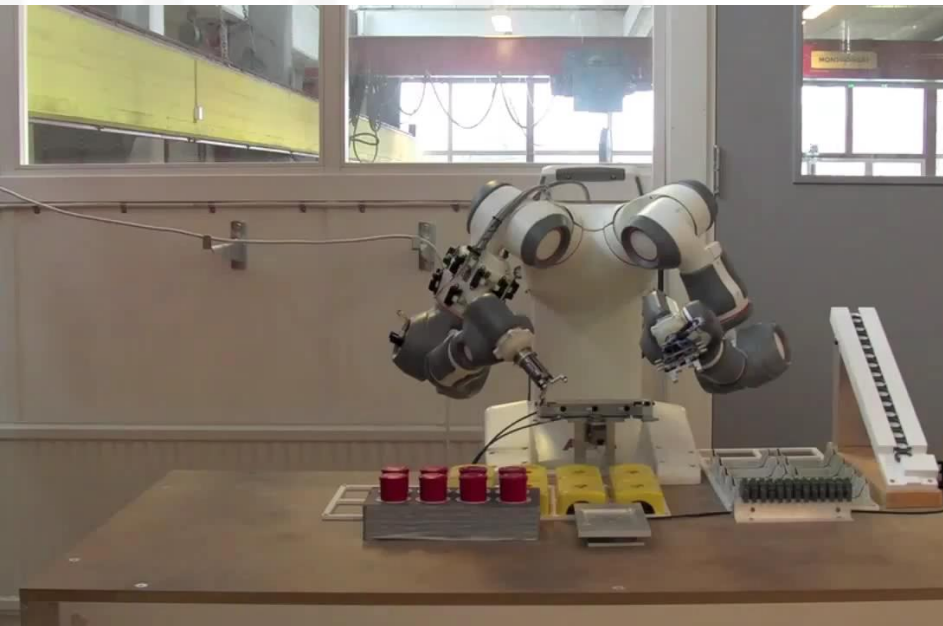
RObot control for Skilled ExecuTion of Tasks in natural interaction with humans; based on Autonomy, cumulative knowledge and learning

Large-Scale Integrating Project

4-year project, 2009-2013

Total budget of about 10 MEUR

European Community's Seventh Framework Programme



Network:



Latest achievements



KUKA Innovation Award Finals 2014
(source: KUKA)



IROS 2015 Best Student Paper Award
Finalist

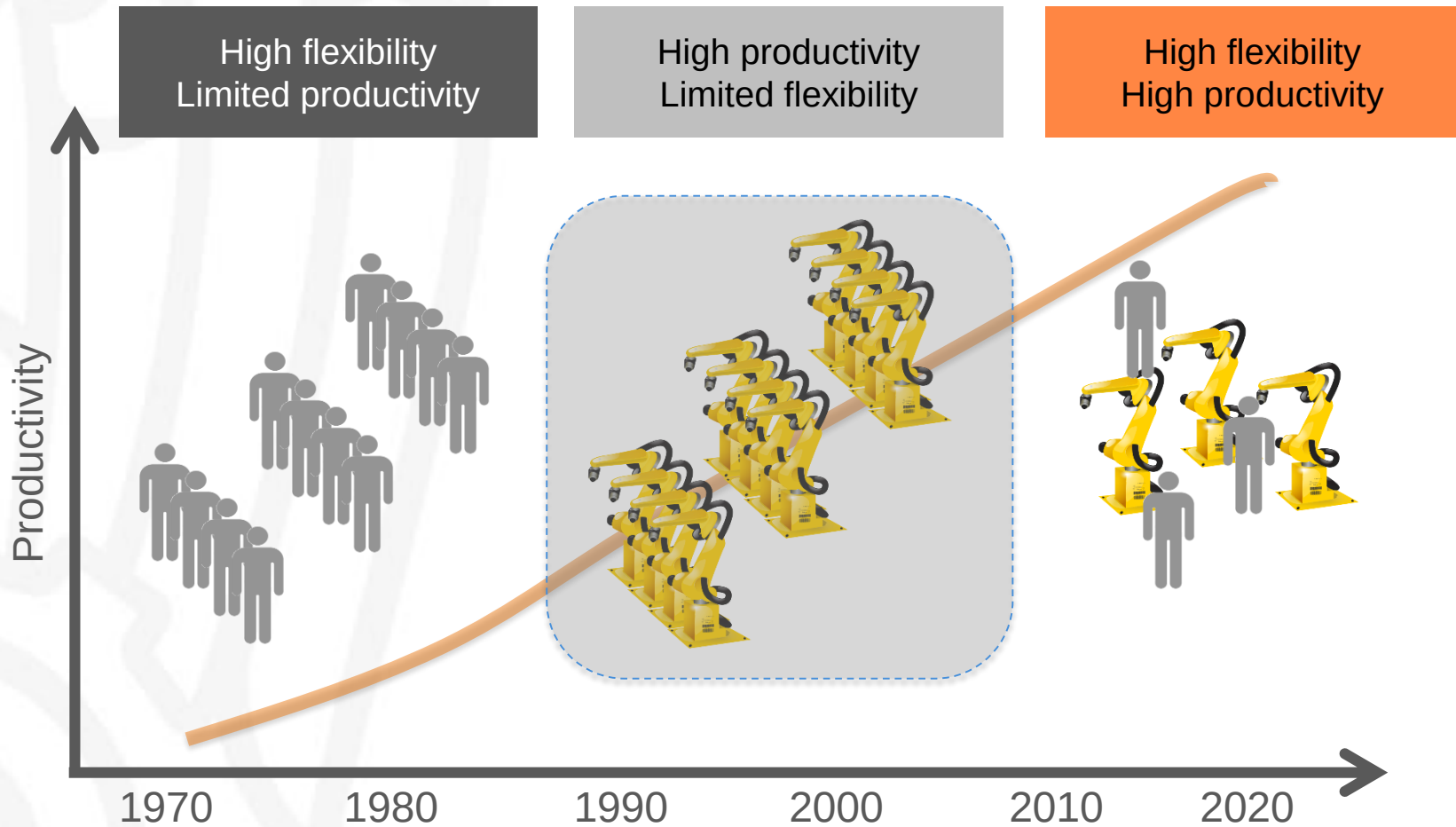


IEEE I-RAS Young Author Best Paper
Award 2014



UCIMU Award 2015 for Innovative
Master Thesis

From robots to cobots



Current applications

Automotive: gluing, sealing, quality control, assembly
(Daimler, VW, BMW)

Source: Universal Robots



Home appliances: quality control and assembly (Bosch)

Source: KUKA, Bosch

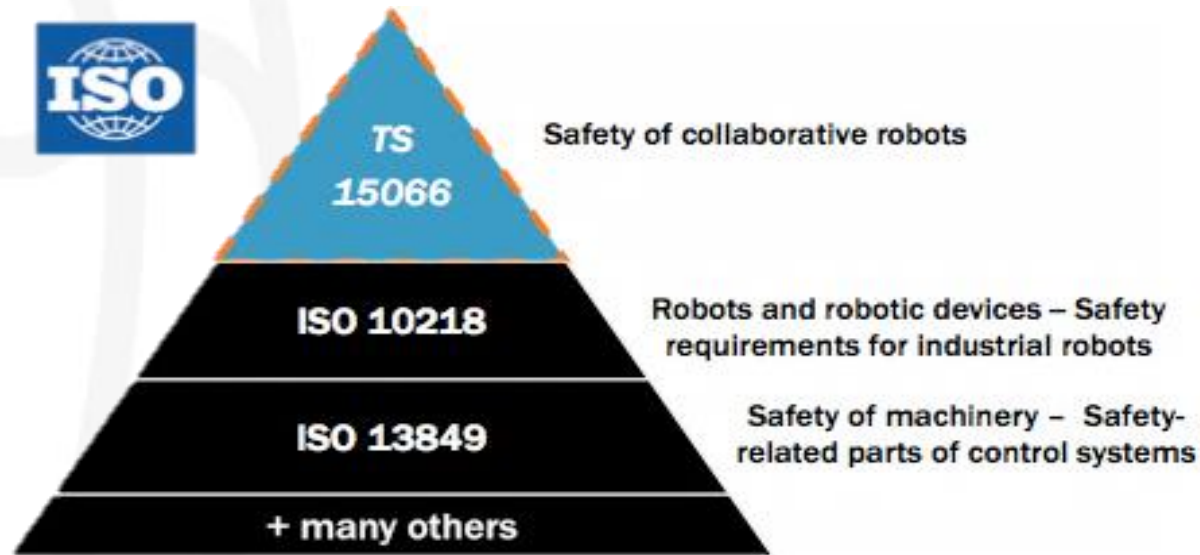


Electronics: assembly, quality control
(ABB, Continental, myFC, Kurtz Ersä, etc.)

Source: ABB



Safety: the challenge



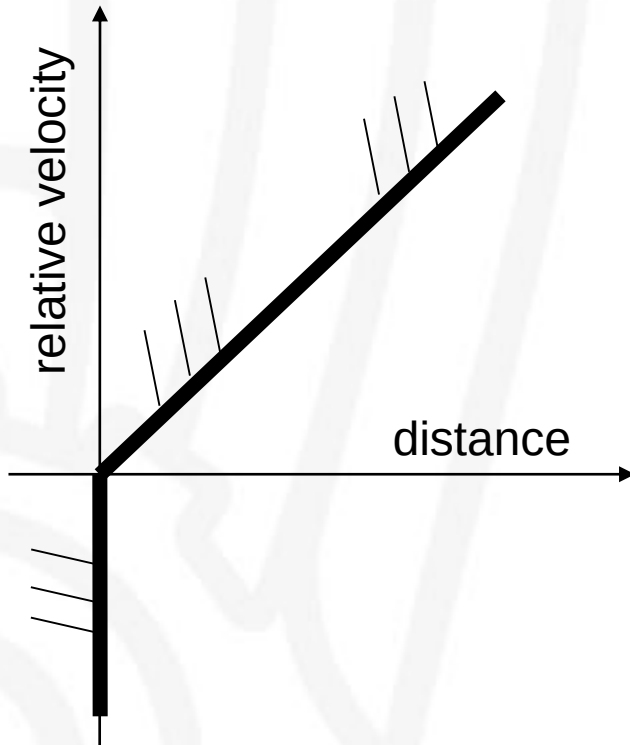
Energy transfer $\Delta T = \frac{1}{2}mv_r^2$ Energy deposit $\Delta T = \frac{1}{2}kx^2 = \frac{1}{2}\frac{F^2}{k}$

Boundary $mv_r^2 = \frac{F^2}{k} \Rightarrow v_r \leq \frac{F^{max}}{\sqrt{mk}} \approx \frac{p^{max} A}{\sqrt{mk}}$

Safety: the challenge – cont'd

Accounting for **safety as a constraint** like in ISO standards, i.e.

$$\text{Distance} \geq \text{Relative velocity} * \text{StoppingTime}$$



Productivity aims at maximizing the robot speed along the path



Safety constraints might require the robot to slow down on path

Frequent stops kill productivity

Unplanned downtime can cost as much as \$20,000 potential profit loss per minute, and \$2 million for a single incident.

Jason Tsai, vice president of product development at FANUC



Source:
ABB, Continental



Source:
Alumotion s.r.l.



Source:
Universal Robots, Nortura

Our solution

An innovative patent-pending supervisor that guides any cobots, by providing real-time suggestions to **maximise productivity** without compromising safety.



Patent Pending
IT-102016000051644

What we offer / look for

What we offer

- *Experience in human robot collaboration*
- *Engineering skills and technological solutions*
- *Research effort to solve challenges*

What we look for

- *Case studies (for fairs, events, exhibitions, etc.)*
- *Supply partnership towards customers*



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Domande?

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Andrea Zanchettin (andreamaria.zanchettin@polimi.it) 6 luglio 2016