BULGARIAN ACADEMY OF SCIENCES
INSTITUTE OF ROBOTICS
(IR-BAS)

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“Robotics & Mechatronics and Social Implementations”
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Development of Robotics, Service Robots and Results of IR-BAS

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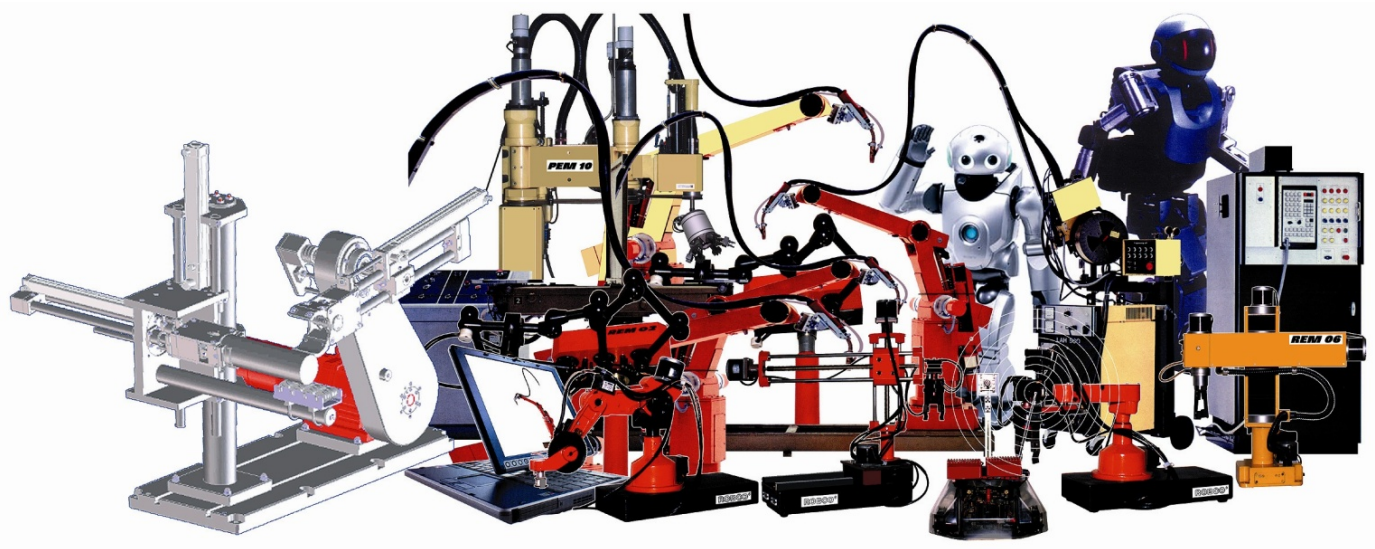
Service robots assist human beings, typically by performing a job that is dirty, dull, distant, dangerous or repetitive, including household chores. They typically are autonomous and/or operated by a built-in control system, with manual override options. The term "service robot" does not have a strict technical definition.

The International Federation of Robotics (IFR) has proposed a tentative definition: "A service robot is a robot which operates semi- or fully autonomously to perform services useful to the well-being of humans and equipment, excluding manufacturing operations



Science fiction has led the field of robotics, like so many other disciplines, with visions of technology far beyond the contemporary state-of-the-art. The term “robot” was coined by Czech author Capek in his 1924 production of “Rossum’s Universal Robots.”

The robots were played by human actors, and dealt with the
issues of slavery and subjugation that were metaphors for concerns held by human workers of the day. These
first robots were also the first humanoids, at least in theater.

Asimov, Will Smith,
I Robot, 2004.

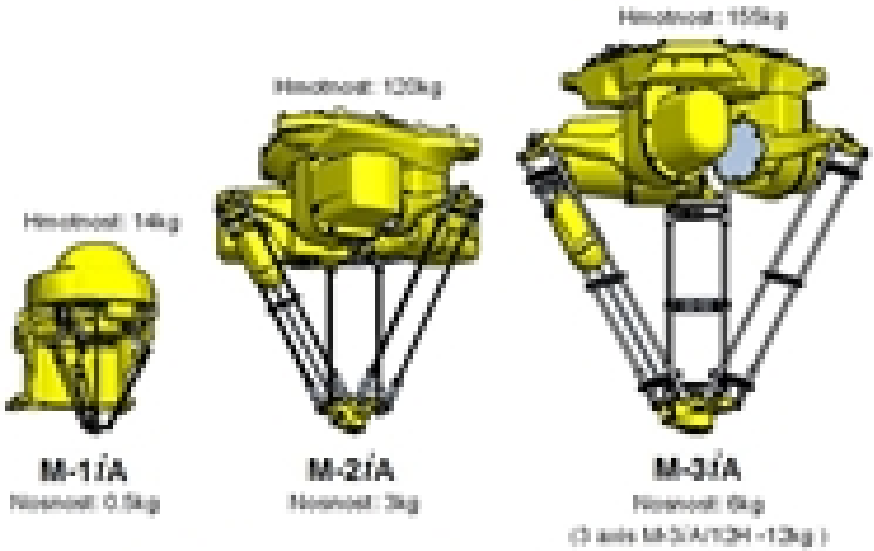
Robots gained another foothold in science fiction with the works of Asimov, where the term “robotics” was first defined in 1941 as a discipline of study. And once again, the form and functions of the robots being studied and built (in fiction) were humanoid. The above figures show the evolution of science fiction from the earliest works to modern media.

CLASSIFICATION
of the Robots according their function

- **Technological robots** - according to the relevant technological process:
  - Painting robots.
  - Robots for manipulating details.
  - Welding robots.
  - Mounting robots.
  - Agricultural robots.
  - Underwater robots and others.

- **Servicing robots** - according to their purpose:
  - Information robots.
  - Robots serving the way of life of man.
  - Robots for entertainment.
  - Medical robots and others.

Painting robots FANUC

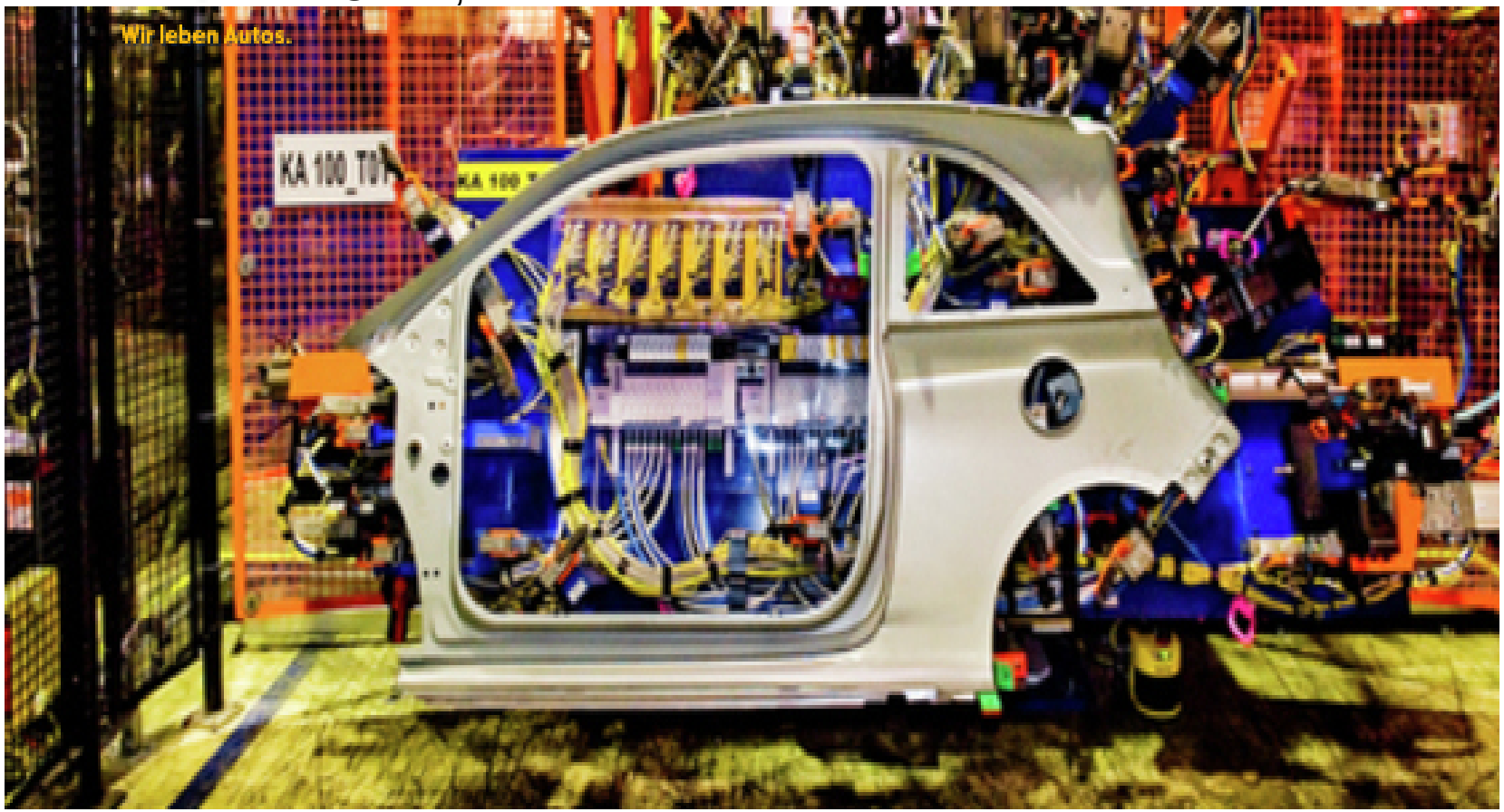



LRM 200iD

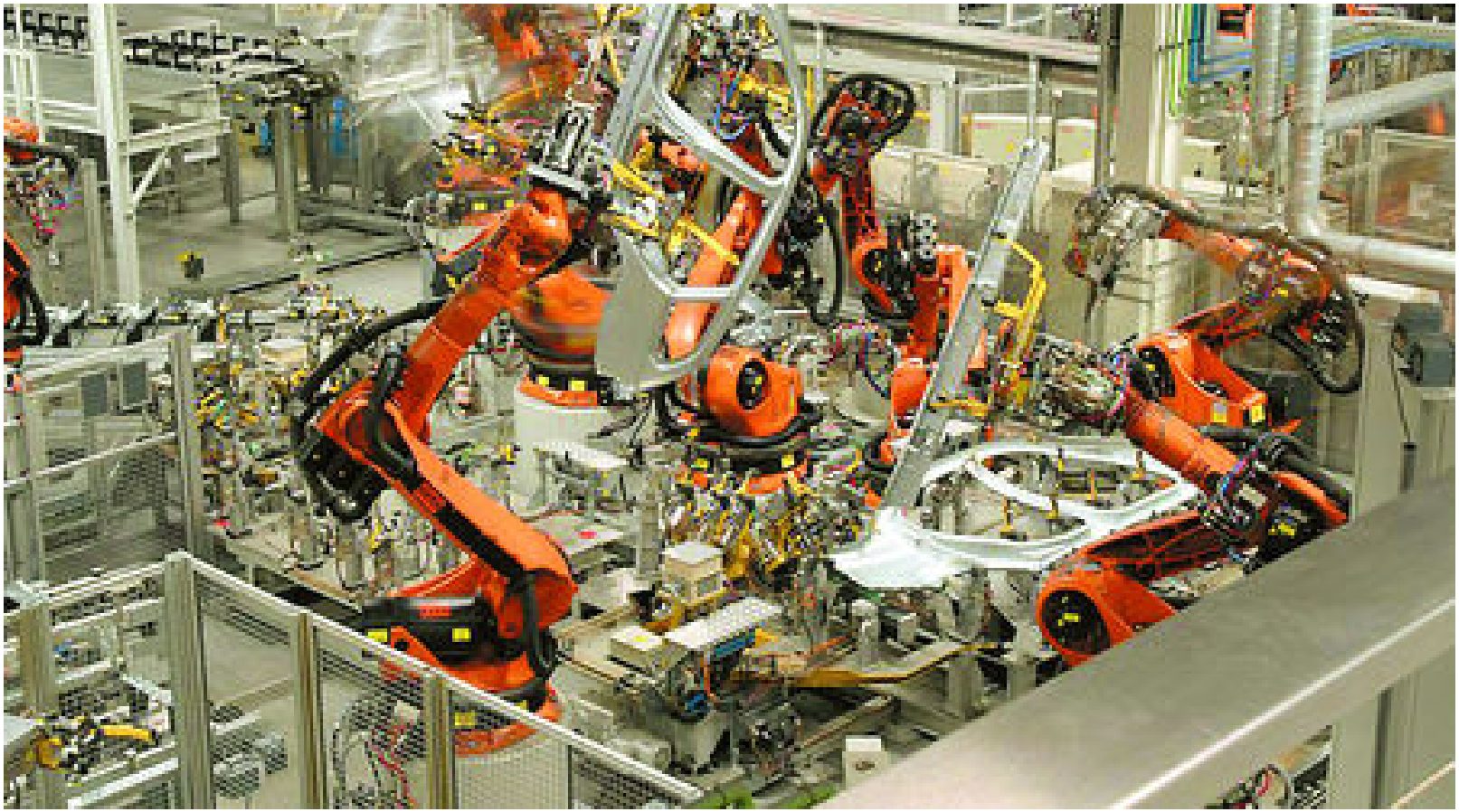

ARC Mate 0iA

Welding Robots

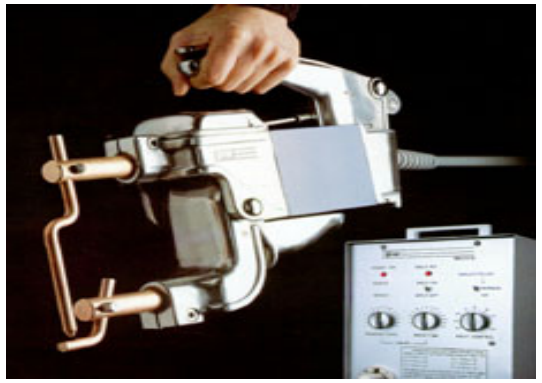
Robots for manipulation of details, Eisenach, Germany
OPEL, ADAM



Robots for manipulation of details. BMV Group.



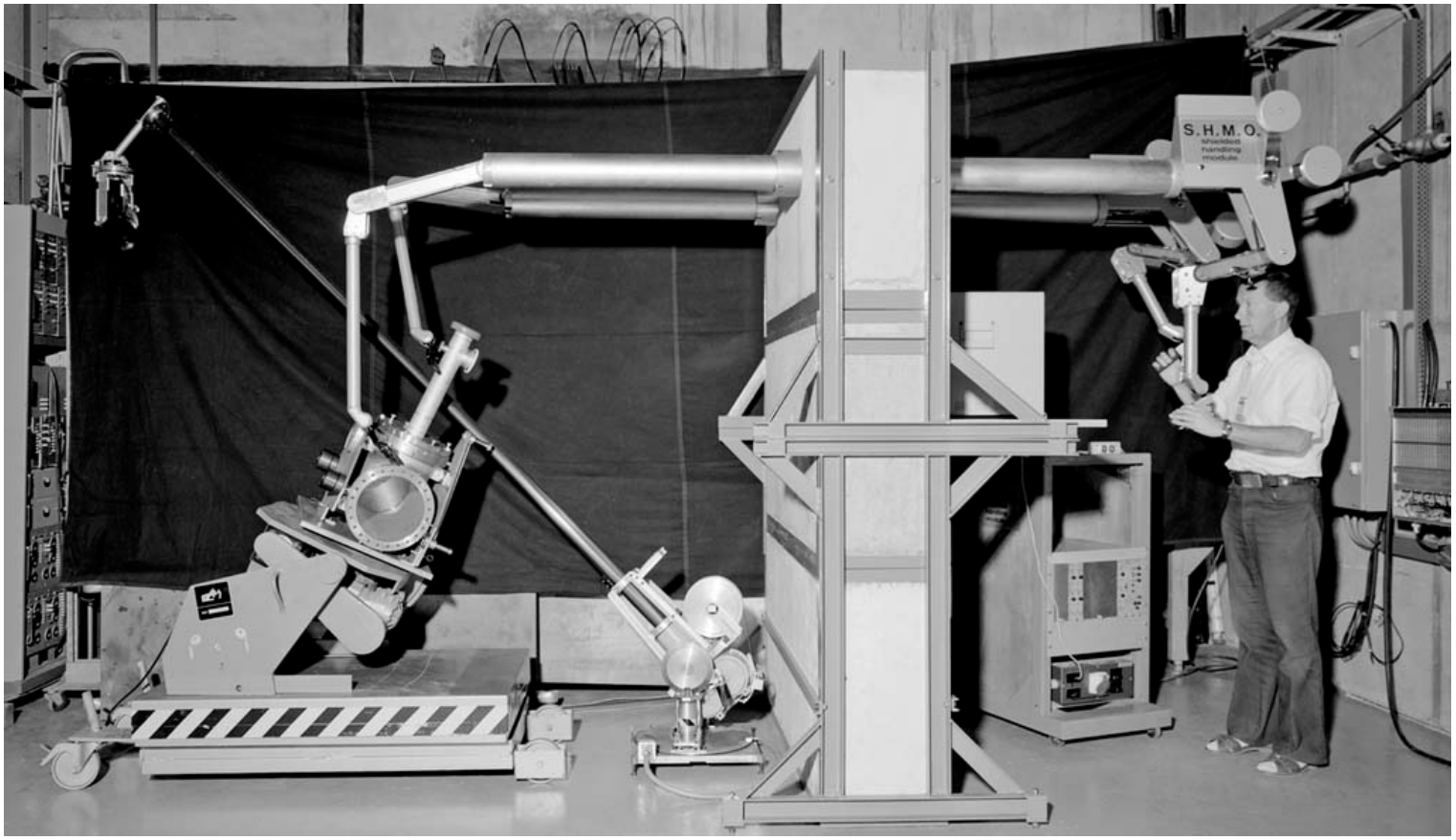
Welding Robots



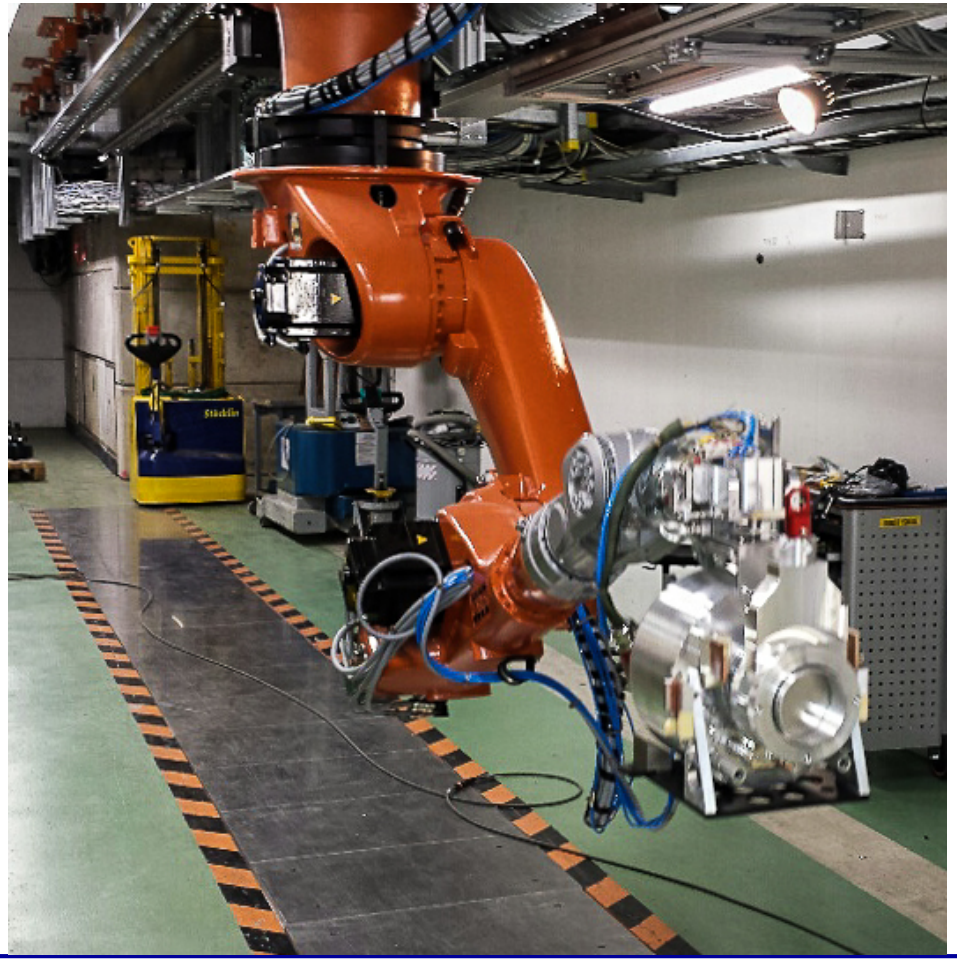
KUKA_Robocoaster.mpg

Service Robots at CERN

“Master – Slave” Manipulator for Radioactive materials 1981.

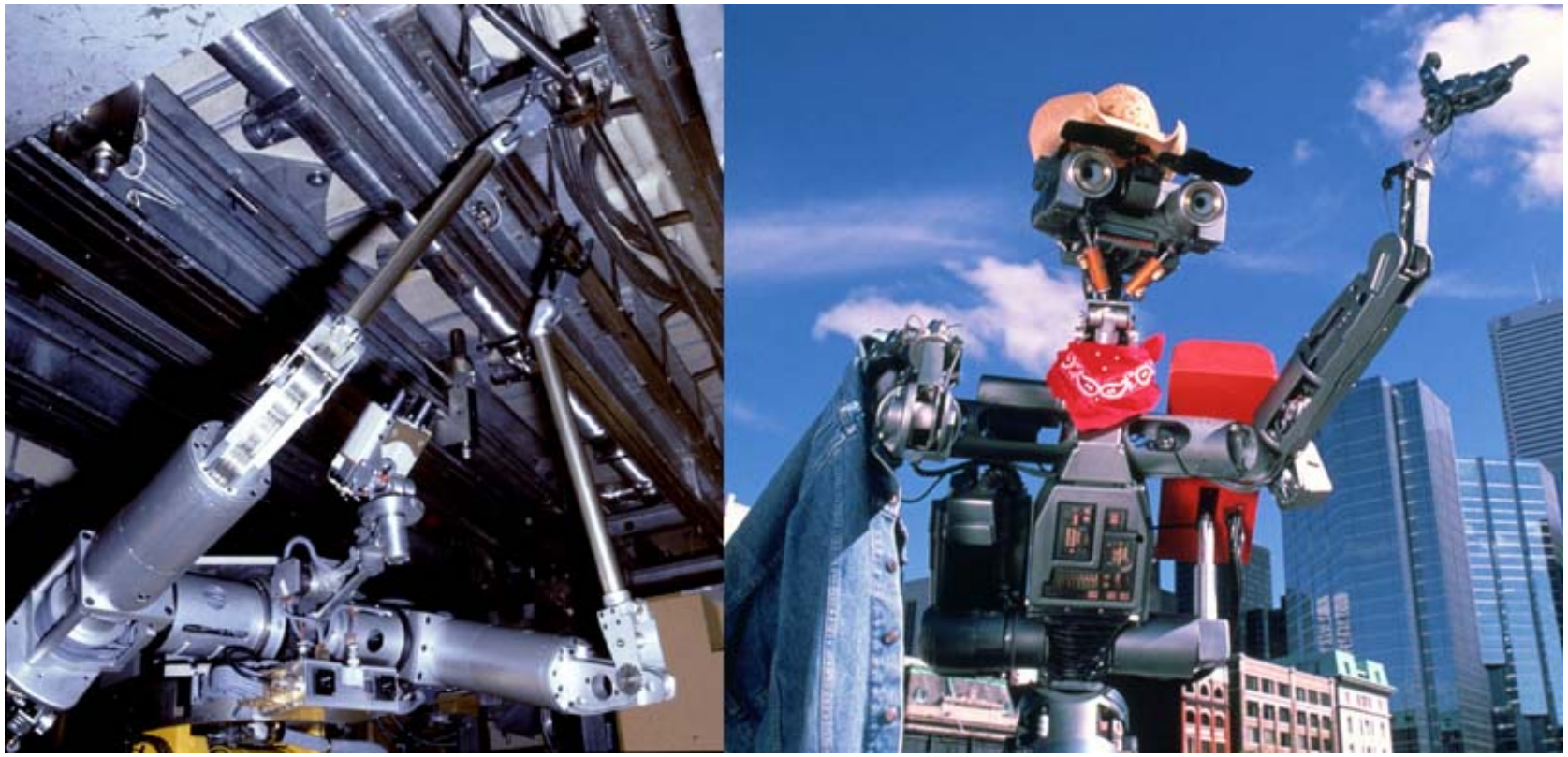


Robot for manipulation at ISOLDE Experiment, CERN for Manipulation of Radioactive materials.



"Remotely-operated equipment for inspection, measurement and handling." TIM is expected to be useful for preliminary environmental inspections before workers or emergency crews enter. It may also be used for inspecting the collimators, which become one of the most radioactive elements of the machine after running. (The collimators sweep away stray protons around the beam and so end up taking a substantial particle bombardment.)

"MANTIS – a compact mobile remote-handling system for accelerator halls and tunnels",



MANTIS (left) и Number 5 (right)

HUMANOIDS
Servic Robots

HUMANOIDS

Toyota

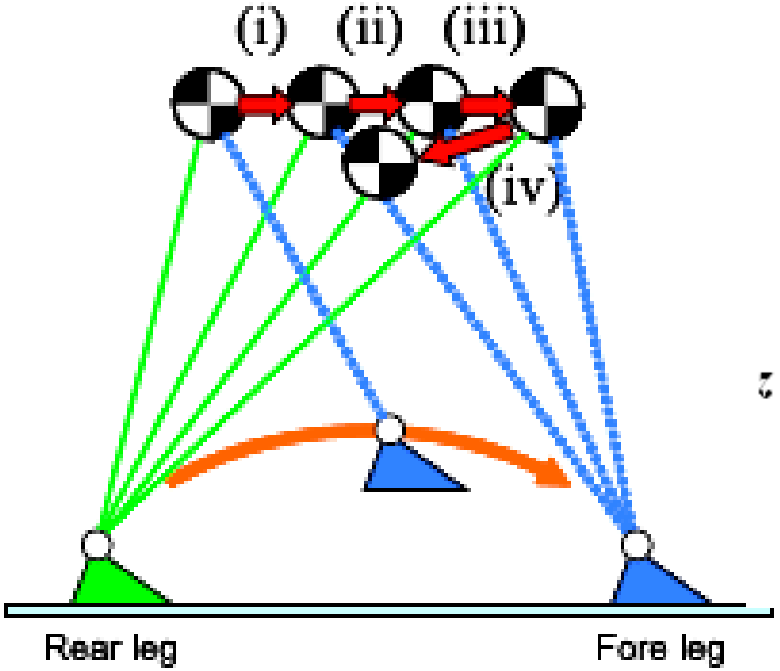
Honda,
МОДЕЛ R-2

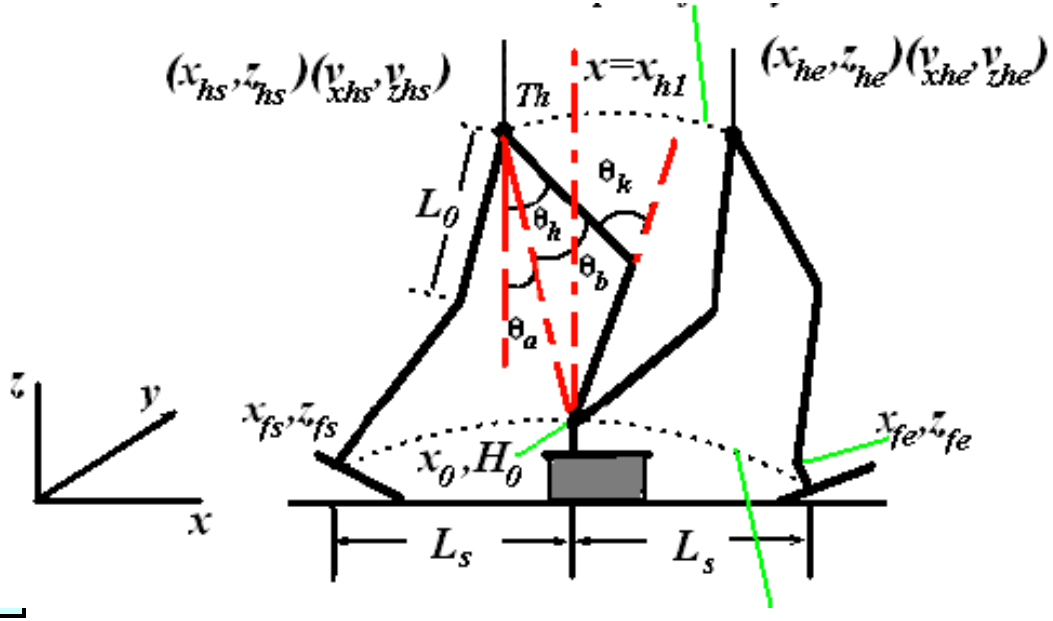
HUMANOIDS

Sarcos

MIT

NASA





“Zero Moment Point “(ZMP) algorithm (Vukobratovic and Frank, 1969), (Vukobratovic et al., 1970).

Mobile Robots

Workpartner_outside.mpg

Carnegie-Mellon University, Stanford, RWTH Aachen DLR.

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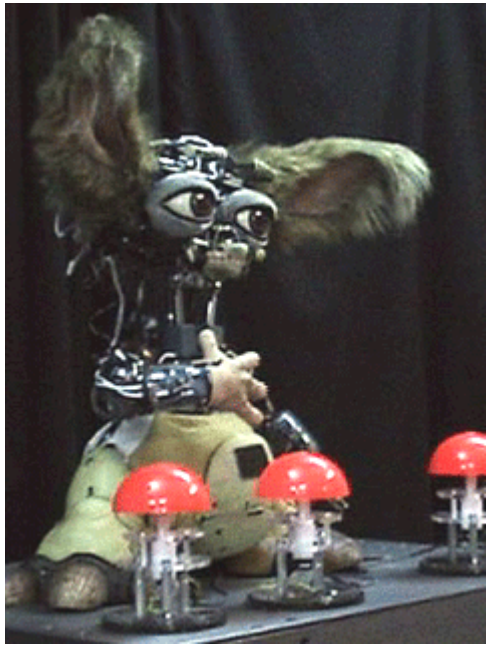
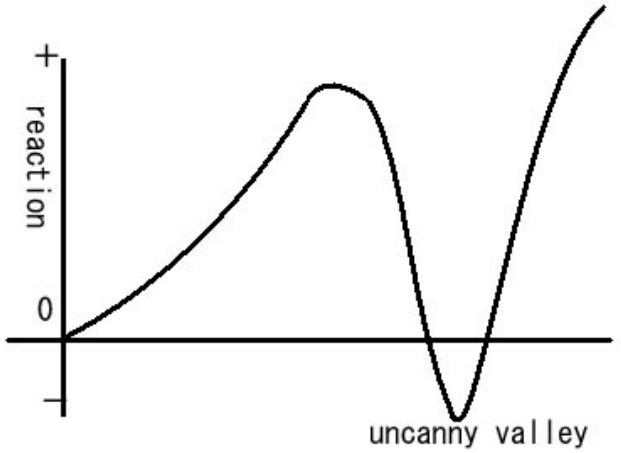


Honda, Osaka Univ., MIT KAIST.

Research at Osaka University and other sites is exploring the “Uncanny Valley” first postulated by Professor Mori in 1970, where the degree of human-like form and motion in human faces (Minato et al., 2004) is found to have a local minima in reaction.



HONDA, ASIMO.

HONDA, ASIMO, H=1.3 м,

The environment offers very complex dynamics of movement of bodies in it, as well as stochastic behavior in time and space.

A key role for this has the following features of the physical environment, on which the robot behavior is built and modeled in real-time mode:
-The complexity of the tasks the robot will solve in the middle.
Uncertainty and stochasticity of the following elements:
- A priori knowledge of the environment, perceptual information,
- The results of the robot's actions.

Technological Robots from IR-BAS

Laboratory for Assembly Robots – IR-BAS

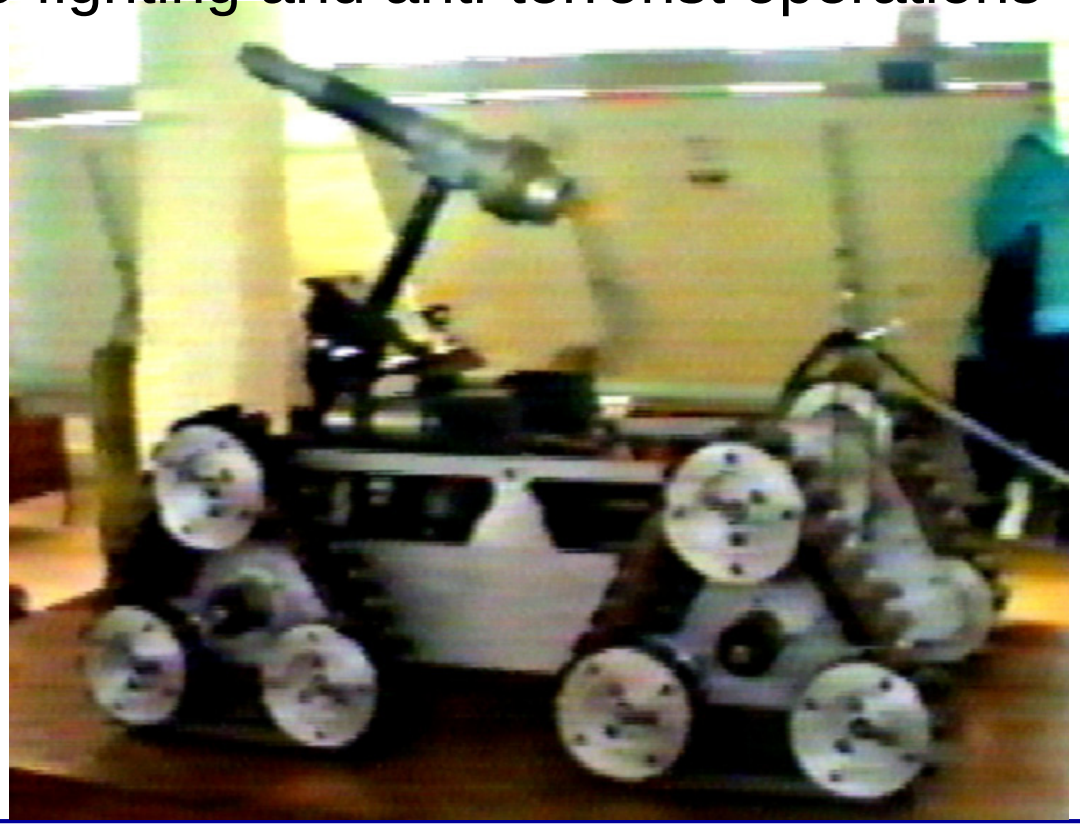
AnRI 0 (ROBCO 11)

AnRI 1 (ROBCO 12)

Mobile service robot with voice interface for operator interface.

Possibility to use iPAD or phone as a programming terminal in dialog mode.

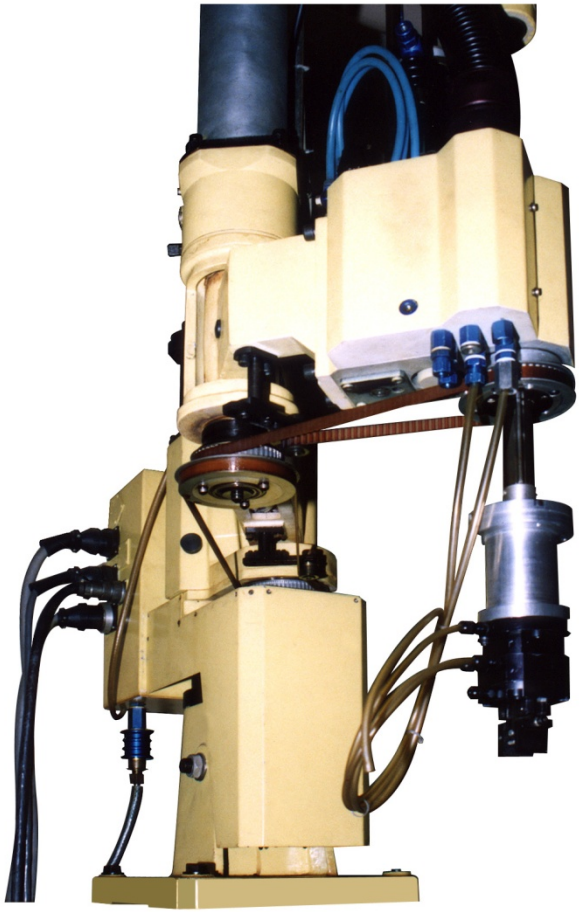
DANGEROUS ENVIRONMENT
Mobile off-road robot
fire-fighting and anti-terrorist operations

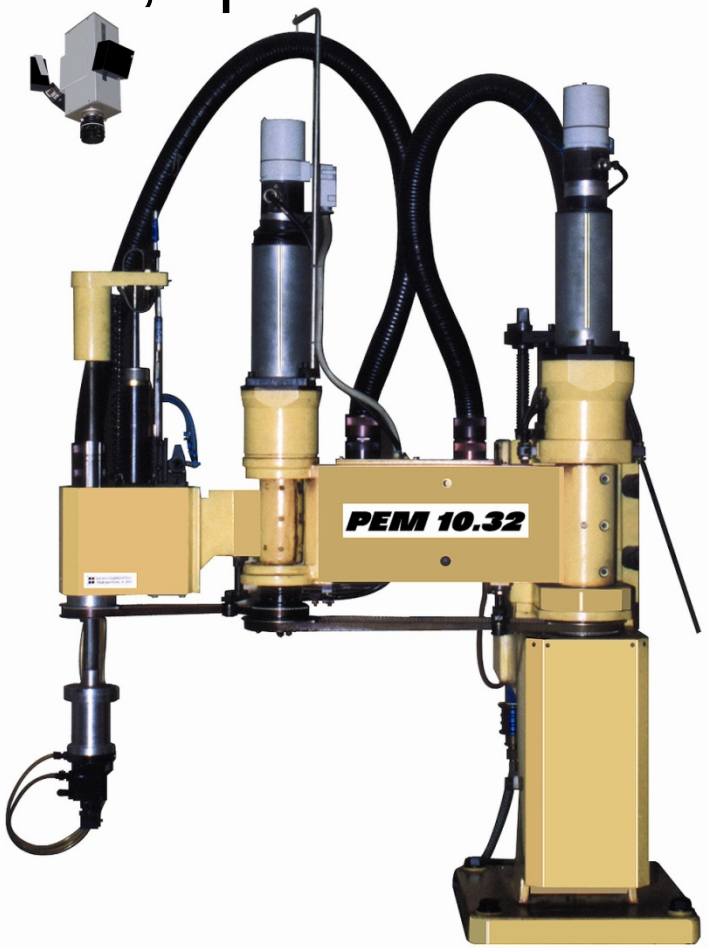


Assembly Robot REM10 with “RoCon” Control

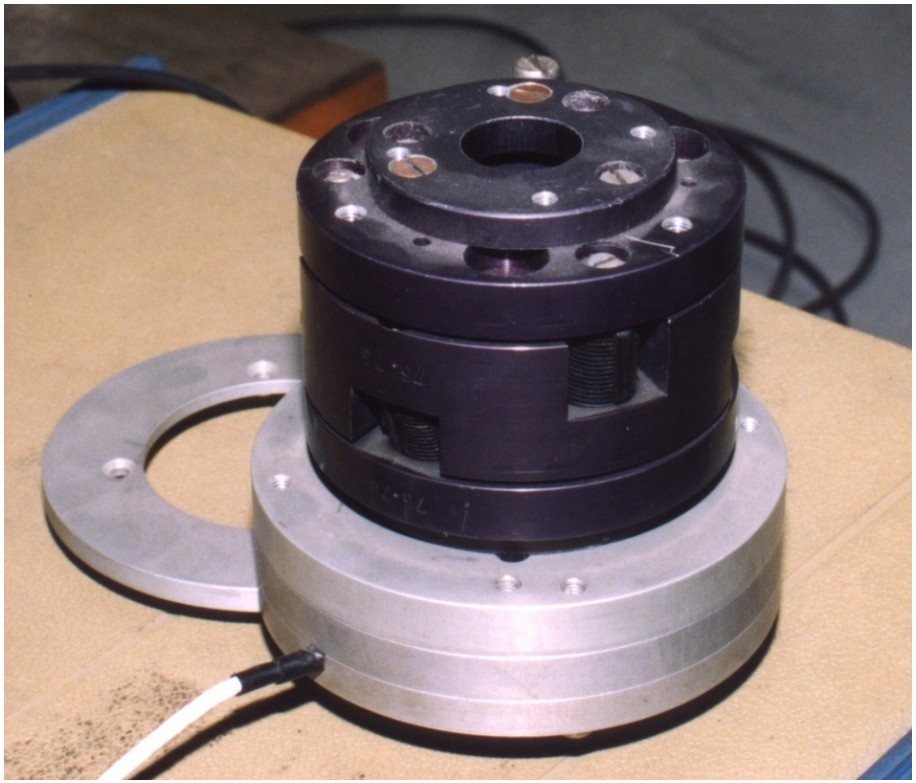
Load capacity: 10 kg.
Positioning accuracy: **+- 0,02 mm**

Assembly Robot PEM 10-32, tipe ”SCARA”

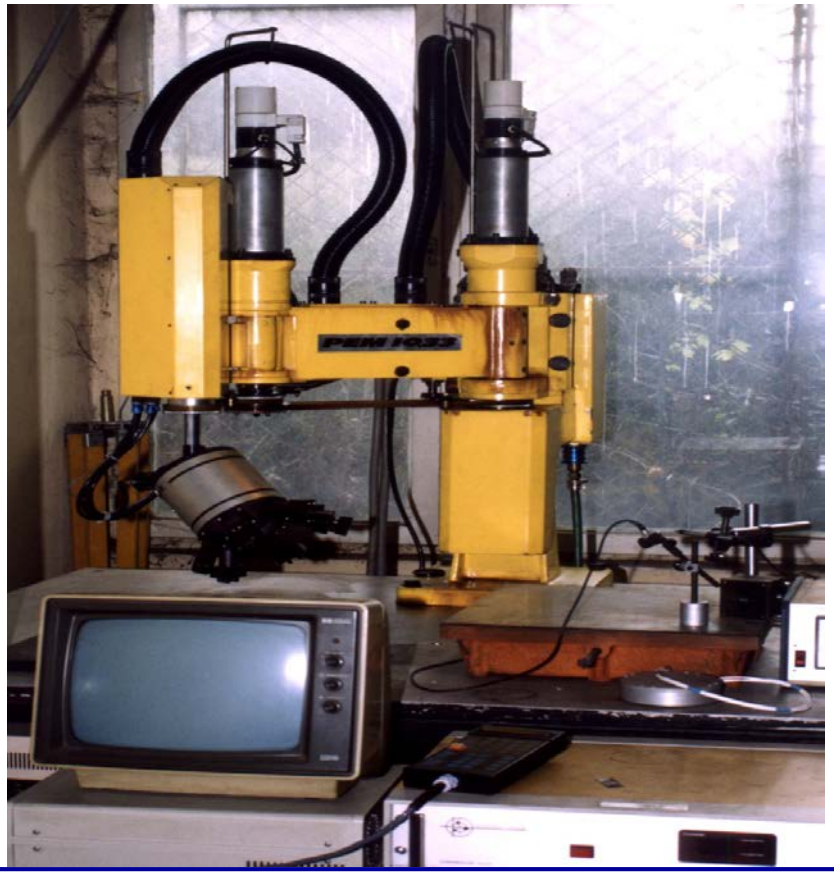


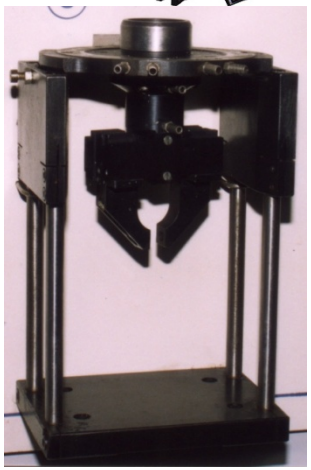


Complex passive and active adapter in the wrist of Assembly Robot

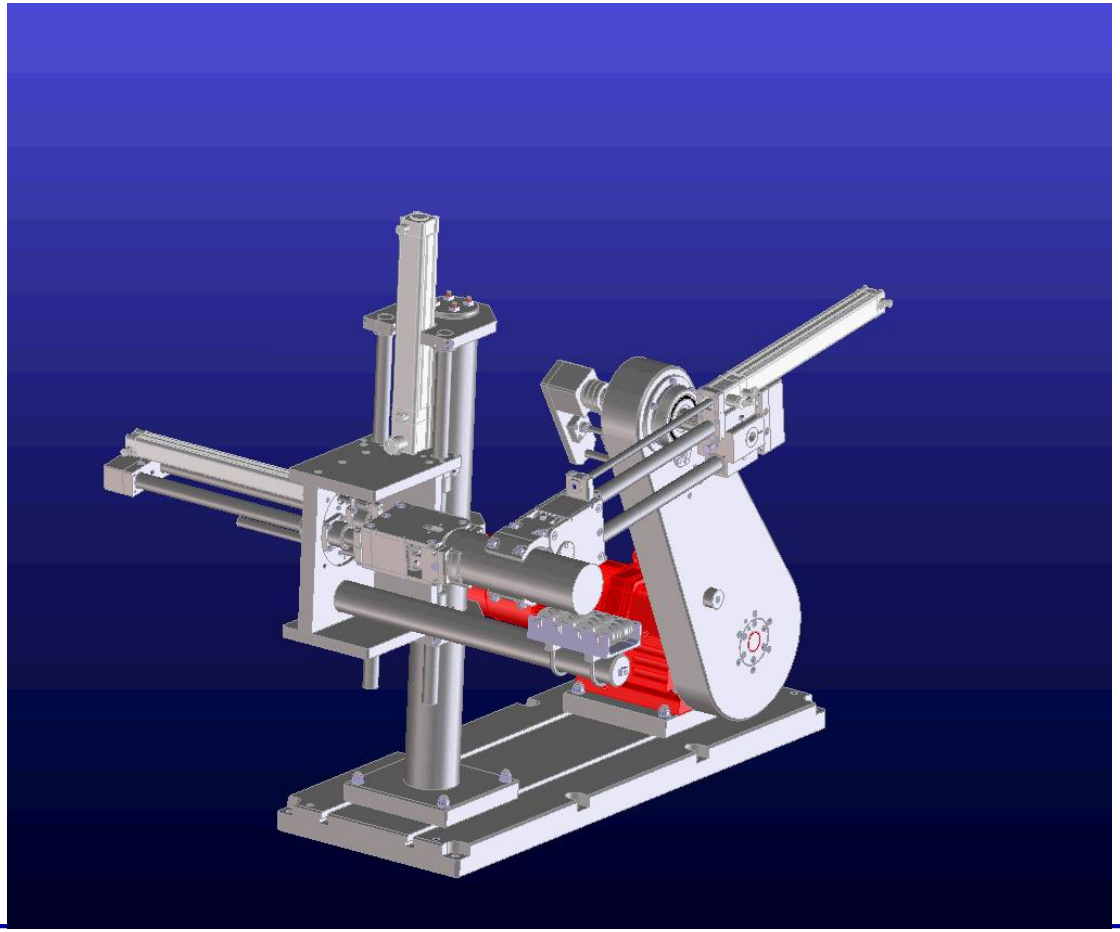


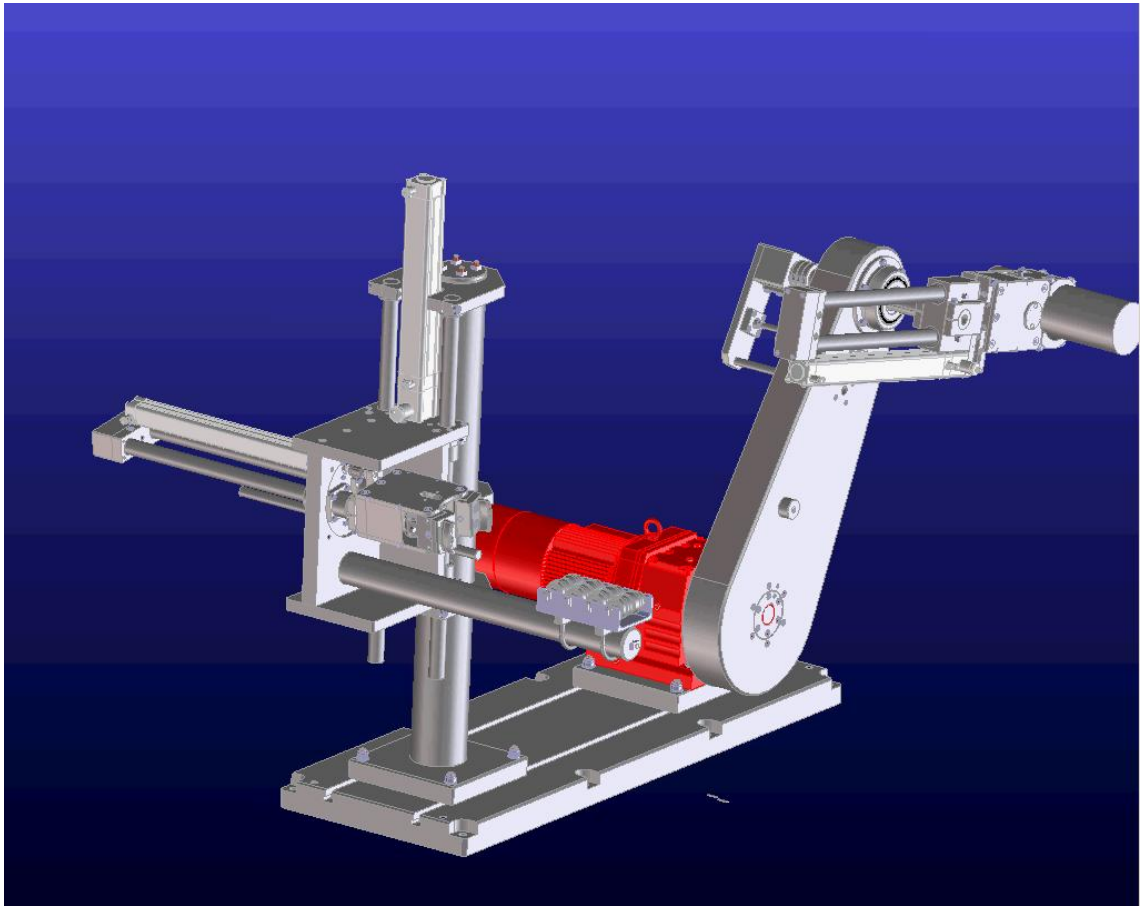
Tools Changers for Assembly Robots

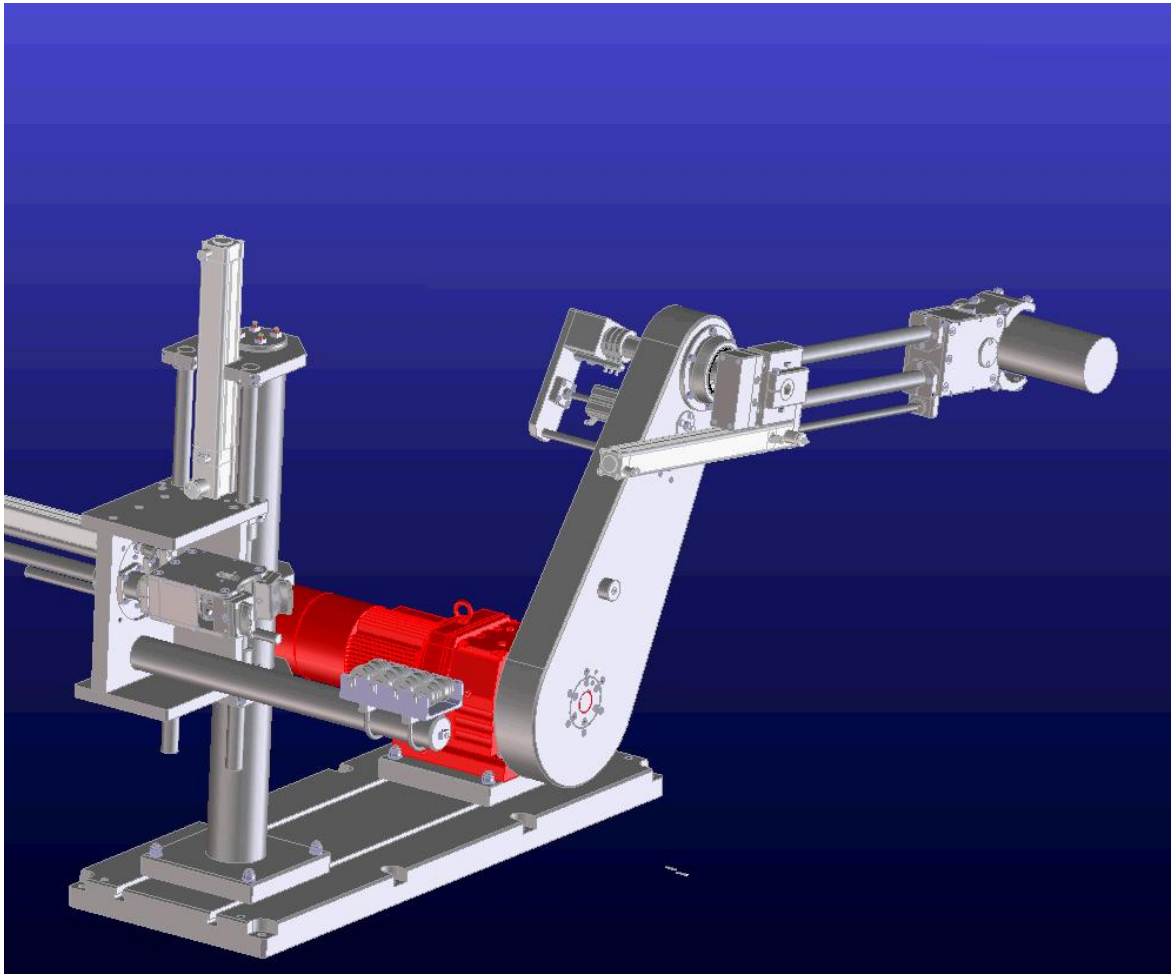




Robot for the production of Aluminum Profiles





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Thank you for your attention!