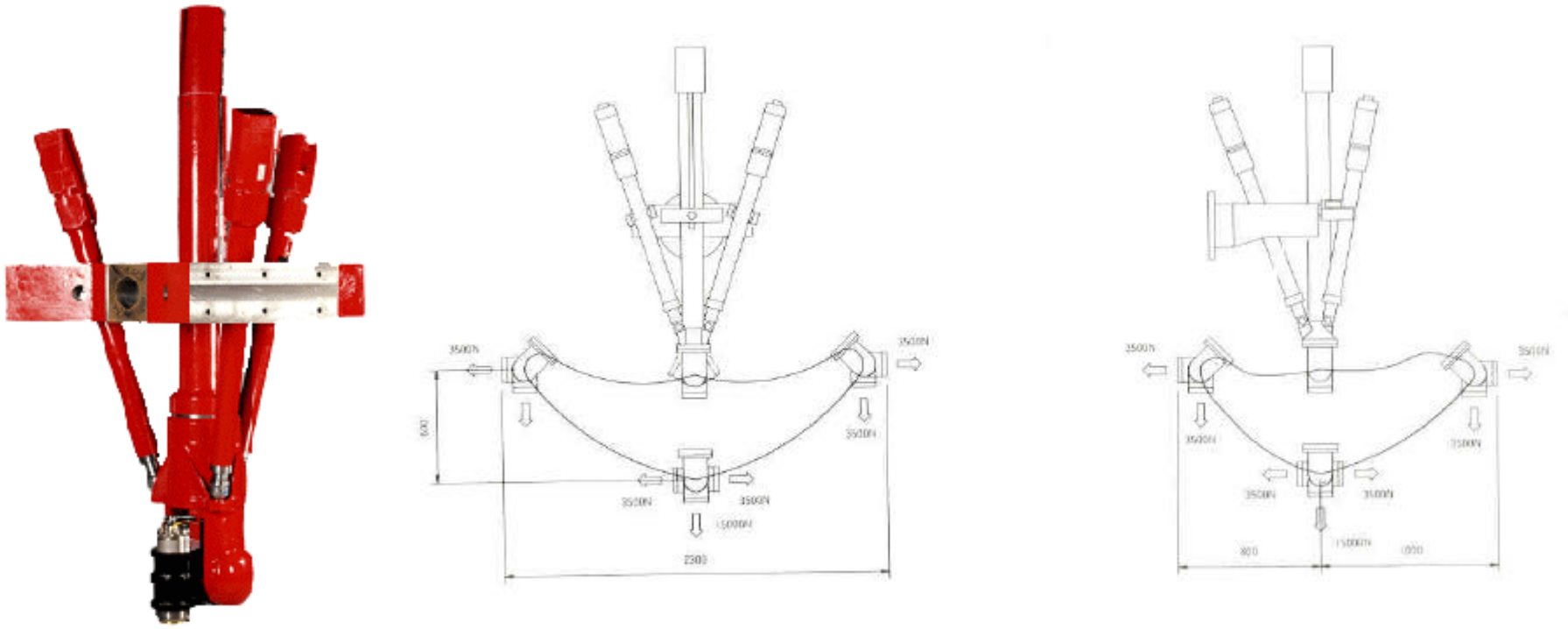
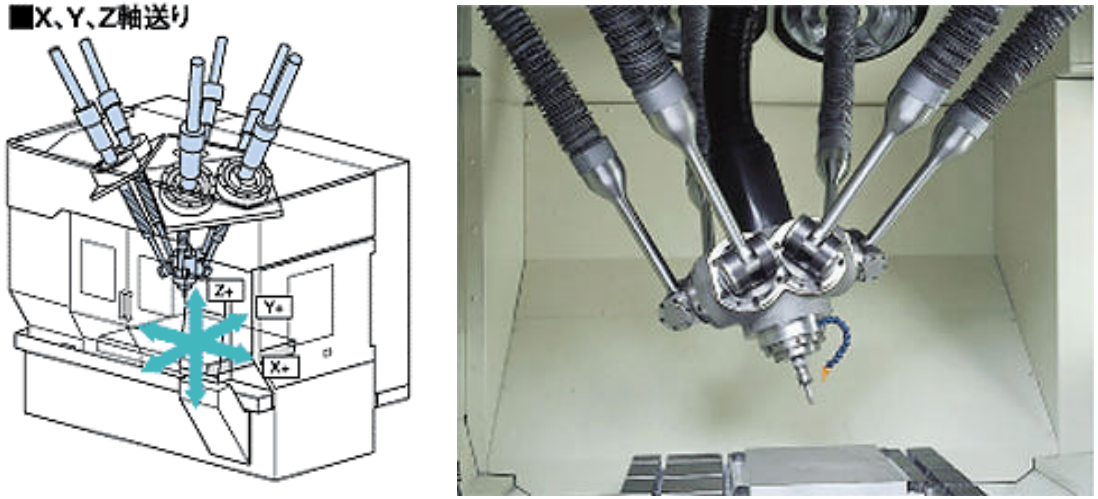


a) b)

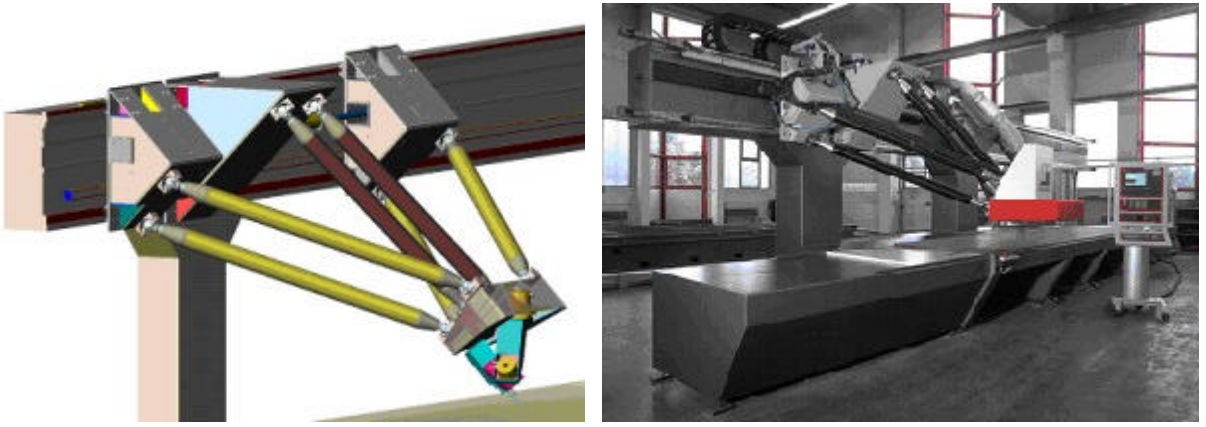
Figure 8. The Tricept 850 by SMT Tricept (SMT Tricept 2003): a) commercialized robot; b) side view of the workspace .

Figure 9. F-200iB manipulator commercialized by FANUC, (FANUC 2003).



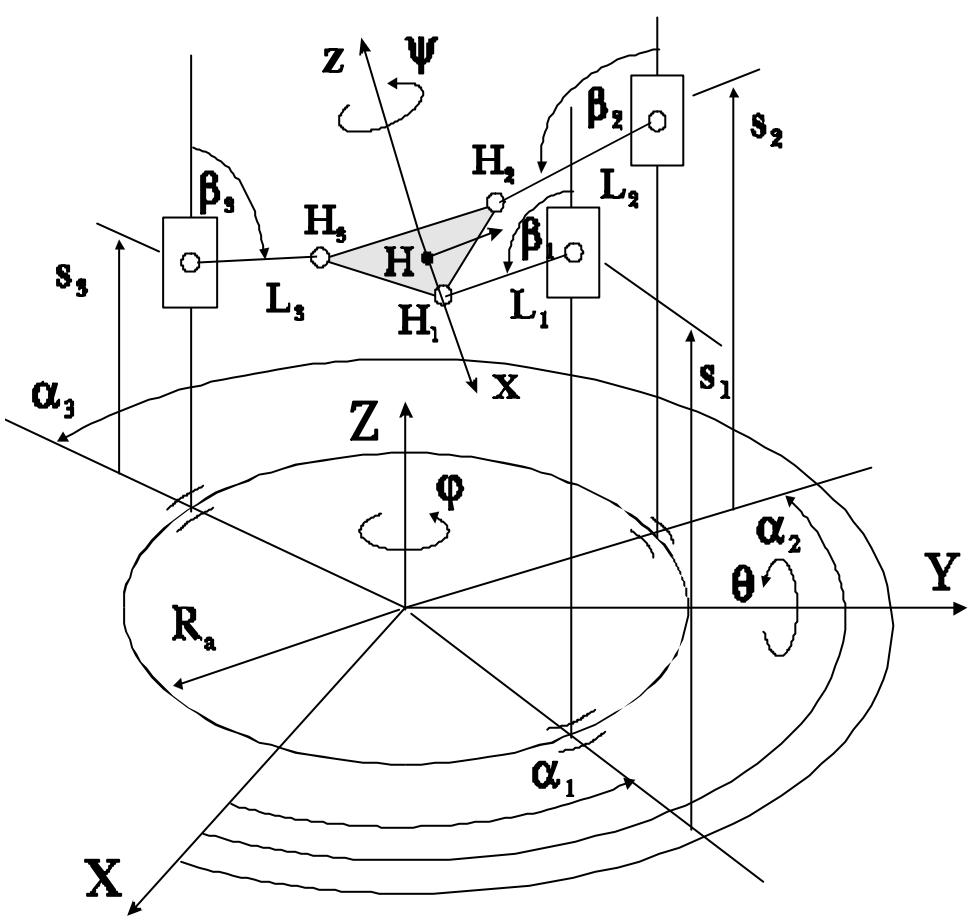
a) b)

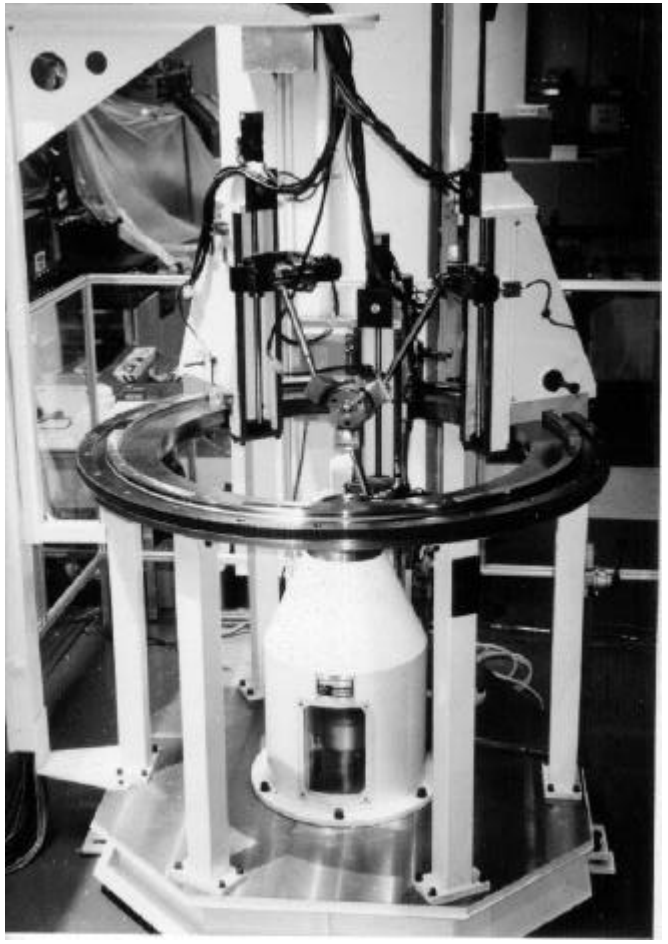
Figure 10. PM-600 robot by OKUMA, (OKUMA 2003): a) a scheme of the overall machining center; b) a view of the commercialized robot.



a) b)

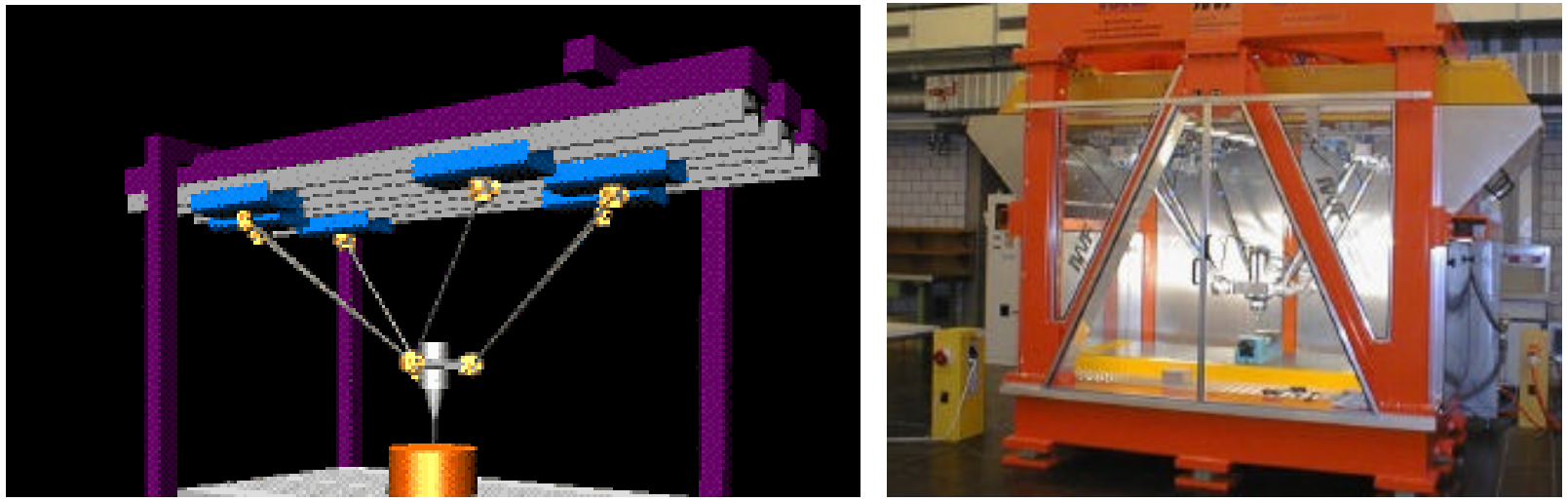
Figure 11. PEGASUS robot commercialized by Reichenbacher, (Reichenbacher 2003): a) a CAD scheme; b) the manipulator in the work cell.





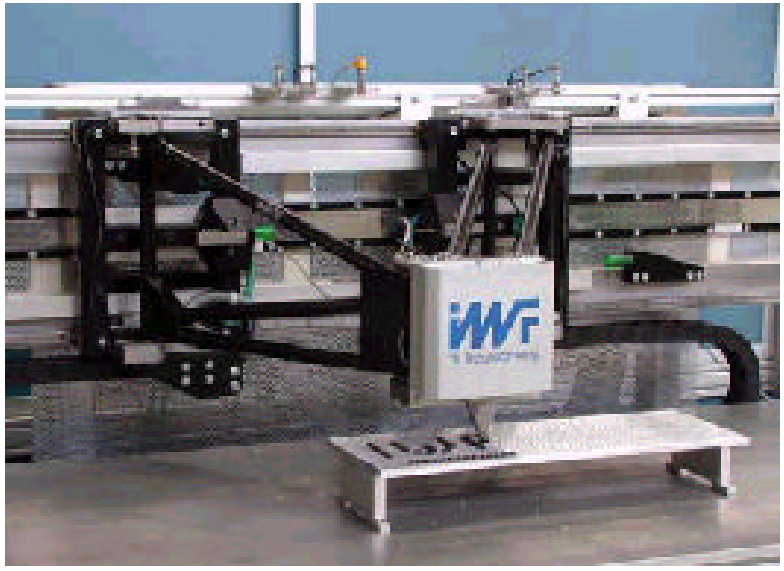
a) b)

Figure 12. Eclipse robot developed at National Seoul University, (National Seoul University 2003): a) a kinematic scheme; b) a first prototype. VIDEO



a) b)

Figure 13. Hexaglid robot developed at ETHZ (ETHZ 2003): a) a kinematic scheme; b) a prototype. VIDEO



VIDEO

Figure 14. PORTYS robot developed at Braunschweig Technical University, (Hesselbach et al. 2003).

applications

- Manipulation platforms for heavy workpieces in manual production lines for example in assembly lines.
- Handling-platforms for heavy workpieces in automatic production lines for example in assembly lines.
- Motion-platforms for simulators such as flight simulators, vehicle simulators, special devices etc.
- Drive systems for NC-machines for example milling machines.
- Robotic applications
- Workpiece / stress testing equipment

The Hexamove system enables the user to initiate force- and momental vectors acting in any direction in the space!

Concept for a tool machine

The picture shows a prototype of a milling machine which was developed and built in cooperation with a concept development and evaluation program at the advanced technical college in Luzern.
The development program included a complete CAD/CAM linkage, in which planar coordinates in standard 5 axis ISO-code were used. This program-code was transmitted directly to the Hexapod system. The control system works with splines for the curve path and automatically calculates the motion programs for every of the six high dynamic hydraulic axis. The loop control-and synchronisation functions are realized with DSP's.
The concept basically allows complete machining and manufacturing of parts with exceptional shape and geometry. Milling a toward the inside open cone into a workpiece was possible without problems.

Medical operation robotic-system

Three years ago neurosurgeon Dr. Volker Urban introduced his "OP 2015" to the public. At this time it was still a virtual-reality-vision. In the meantime a part of this vision became reality. Supported from the medical laboratory of the Siemens AG, the institute Frauenhofer IPA together with neurological divisions of several hospitals developed the prototypes of the "operation-robot" and "operation-cockpit".

The main goal of the project is to develop a robotic system which enables the surgeons to execute precision operations in the submillimeter range. Due to such a robotic system operations could be made safer and new operation technologies could be developed.

For the operation robotic-system a Hexapod is used. Special advantages of the Hexapod are the excellent accuracy, the high stiffness and the six degrees of freedom for the operation tools.
The operation-cockpit is used as an ergonomic working place for the surgeon. **The whole cockpit is built on an OHE motion platform (Hexapod).** Beside of the visual feedback from the camera in the endoscope, the simulator also conveys the feeling for movement of the operation tools. Beside simple movements, forces to the operating tools can be simulated. Collisions with vascular walls which are not allowed to be injured are simulated with vibrations of the cockpit to pretend a certain resistance.

The vision of the surgeon being a guest in the body of the patient becomes more and more reality.

VIDEO WasedaLeg

3. FUNDAMENTAL CHARACTERISTICS OF PARALLEL MANIPULATORS

Fundamental characteristics can be recognized in:

- complex Direct Kinematics
- limited complex-shaped workspace
- high precision and stiff performances
- size with volume occupancy
- large payload
- high speed and acceleration
- singularities