Chapter 1

ROBOT3D

INTRODUCTION TO ROBOT3D

The **Robot3D** package is a 3D interactive graphic software for simulation and offline programming of robots and industrial robotic cells. All of the functions are accessible through a friendly graphic interface using concepts of industrial robotics. The tools used in the package allow the development of applications for robots in a fast and efficient way making possible to try more design solutions in less time. The package contains a geometric modeler that allows to create 3D wireframe models, and several cinematic models of robots and mechanisms. Its open design allows the addition of new models to the existent library. The integrated language interpreter allows to program complete work cycles and this way to minimize the effort spent in robots programming. The package includes a vast robots library, positioners, external axes, tools and cells.

Characteristic

The ROBOT3D system allows to do the simulation and offline programming of robots and robotic industrial cells using PC's on MSDOS.

The software is configurable for several combinations of external axes (or positioners) and robots. Expansion of the system is possible through a C library (Option).

The software is tested and calibrated for the robots TAURUS BISIACH & CARRU - controller RCM3 of SIEMENS and family IRB2000 (S3 and S4) of ABB and KR15-KR200 family of KUKA Robots..

Other robots that are part of the library exist supplied with the package as IRB1400, KUKA IR163, BOSCH (scara), HITACHI M6100. The language converters for these systems case can be developed.

The inclusion of other robots less usual raise for the development of specific inverse kinematics transformations (special order).

The software generates ASCII files. The *download* and *upload* of the programs for each robot are made through the modules of the respective manufacturers' communications (ex. ROB.EXE of

SIEMENS and OLP3 of ABB) or by direct passage in the case of the systems that allow it (ex S4 of ABB, ACR - SIEMENS)

The system includes in the recording and reproduction of locations the relative information of the axes configuration, in way to avoid ambiguities in the kinematics solution.

Thanks to an original principle it is possible to convert a group of locations in a program file post process or to run it immediately.

The system ROBOT3D allows the calculation of cycle times, synchronous PTP, Linear and Circular movements in 3D. It supports Frames, incremental and absolute programming, subroutines, I/O's simulation, grippers, parametric programming, objects functions, manipulation in the cell, etc.

The package is supplied with a CAD and calibration module (Translation, rotations, Frames calculation), own editor and DXF bi-directional format converter, module of communications, and utilities (e.g. symmetries).

The package has the advantage of introducing the concepts of industrial robotics in a quite simple way being the ideal tool to use in training in robotics.

The learning of the system is very simple. The estimate is that an operator with a basic knowledge of computers (DOS, editor), CAD (just for modeling) and some experience in On-line programming of robots, is capable to explore the system with only 20 hours of training.

The system allows to move directly some didactic robots (e.g.. SCORBOT) with the communications module. Their training capacities turn it an important tool in Universities allowing to concentrate resources in the development of post-processors and applications instead of the development of clone systems.

The system ROBOT3D operates as a real robot. The points are reached using one virtual console (Teach Pendant) with the more usual coordinates systems (Robot, Cartesian, user and tool) and using an absolute or incremental approach..

When the robot moves the movement is not interpolated immediately, only the final position is verified. The locations are recorded with an order number..

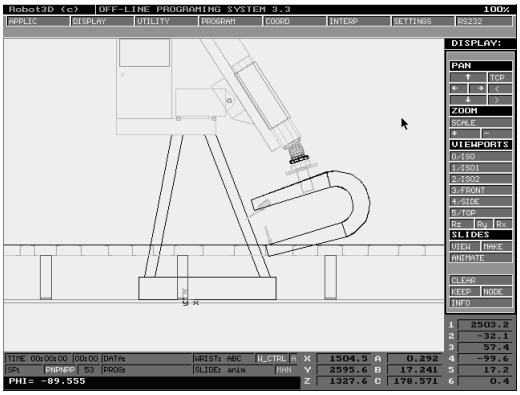
The neutral language file can be created immediately after recording the locations for the disk and the program post-processed and loaded in the robot. If necessary the neutral language file can be completed or corrected in the edition and calibration module.. In case it is necessary to determine the normal to the surface this can be made by an external module.

With ROBOT3D it is possible to reduce the time of simulation of the programs dramatically. To have an idea, a program with 2000 locations it can be simulated in about 10 minutes in DX2/66 MHz machine.

To get these performances the system ROBOT3D it is based on concepts of industrial robotics and in a friendly interface. The system forms an alliance of simplicity with complex functions allowing to develop programs of robots in a very efficient way. It is the key for great productivity.

BISIACH & CARRU ROBOT

ROBOT SIMULATION



Applications

The system ROBOT3D has several applications in robotics:

- Robots simulation and robotic cells
- Offline Programming of robots
- Estimate of cycle times
- Optimize of the layout of cells including peripherals
- Checking the range of tools
- Optimization and trajectory planning
- Design of Jigs for robotics
- Evaluation of different robots for the same task
- Robots design

- Training and investigation in robotics
- Direct drive of robots
- Correction of programs (calibration)
- Commercial uses for robots representatives

Necessary Equipment

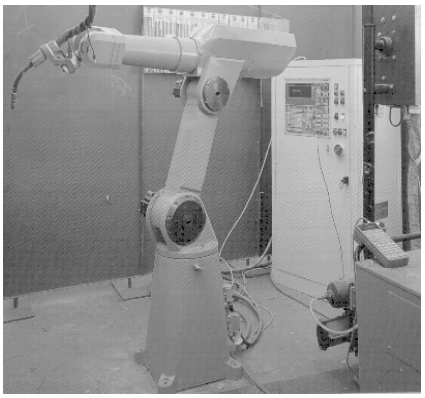
The system runs in a minimum platform 386 DX 33 with VGA and mouse. An optimum performance of the system demands however a Pentium machine 166 or better. The system runs about the memory conventional DOS not needing this way of supplementary RAM. Future versions of the software will be able to however to go through DOS extenders taking advantage the available supplemental memory this way. We advice the use of a VGA monitor with minimum of 17" in to get the best of the graphic screen. As disk requirements we advice a minimum space of 10 Mb. The use of animations can demand however a space of some tenths of MB.

Calibration

The ROBOT3D system allow to perform correction to the programs using specific routines in the RODIT ediditor. It's possible to make coordinate displacement of program sections, rotation about a transformation matrix, mirror of programs and frame calculation based in three points.

SOME HISTORY...

The ***ROBOT3D*** system was presented for the first time in "*3ºs Jornadas de Projecto Planeamento e Produção Assistida por Computador*" (FIL - International Fair of Lisbon) in 1991.
F.Fernandes was one of the creators of 1st Portuguese Industrial Robot (SA6010 - anthropomorphic 6 axes robot for arc welding) and initially developed the software *ROBOT3D* to simulate this robot. F.Fernandes is MS in Mechanical Engineering and works in robotics and automation since 1982. Presently exercises functions in ABB robotics.



TECNIROB SA6010