Robot Programming

PROGRAMMING

Three Programming Methods:

- Manual teaching
- Lead through teaching
- Programming languages

PROGRAMMING contd..

1.Manual Teaching:

- Point to Point applications

2.Lead Through Teaching:

- Continuous Path Programming
- Robot Simulator
- Advantage is direct programming but also have disadvantages

PROGRAMMING contd..

Disadvantages:

- Every motion is recorded and played back in the same manner.So unintentional motions also be played.
- Impossible to achieve exact required velocity
- Memory size is required to store the data.
- Investment in a simulator is required.

PROGRAMMING contd..

3.Programming Languages:

- AL
- VAL
- AML
- RPL

PROGRAMMING contd..

Classification of Robotics Languages:

- First Generation Language
- Second Generation Language
- World modelling and task oriented object level language

PROGRAMMING contd..

First Generation Language:

- Off-Line Programming used in combination with teach pendant.
- VAL is an example of this kind.

PROGRAMMING contd..

Second Generation Language:

- AML,VAL II etc…
- Structural Programming language performing complex tasks.
- Apart from straight line interpolation performs complex motions.
- Uses force, torque and other sensors.
- Data processing, file management and keeping all records is done.

PROGRAMMING contd..

World modelling & task oriented object level language:

- More advanced language is WORLD modelling.
- TIGHTEN THE NUT.
- Intelligence is required.

PROGRAMMING contd..

In a robot, there are 3 basic modes of operation:

- Monitor mode
- Edit mode
- Run or Execute mode

PROGRAMMING contd..

Monitor mode:

- Programmer define locations, load a particular information in a register, save transfer programs from storage.
- Move back and forth into edit or run mode

PROGRAMMING contd..

Edit mode:

- Programmer can edit or change set of instructions.

Run or Execute mode:

- Pre defined task can be executed in run mode.
- Dry run can be tested.
- Debugging.

VAL SYSTEM AND LANGUAGE

1. INTRODUCTION TO VAL:

- Programming language and operating system which controls a robotic system.
- VAL programs also include subroutines,which are separate programs.

VAL SYSTEM AND LANGUAGE contd…

2.LOCATIONS:

- Represents the position and orientation of robot tool.
- Two ways of representing robot locations
  * Precision point.
  * Cartesian coordinates and orientation angles.
- These are called **transformations**.

VAL SYSTEM AND LANGUAGE contd…

3.TRAJECTORY CONTROL:

Two methods to control the path of the robot.

- Interpolate between initial and final position, producing tool tip curve in space.
- Move the robot tip in straight line path.

VAL SYSTEM AND LANGUAGE contd…

3.TRAJECTORY CONTROL:

- For the first case,called **JOINT INTERPOLATED MOTION,** the total time required is that of the longest joint in the robot.
- In the second case, the motion speed of the robot tool tip can be accurately controlled.

VAL SYSTEM AND LANGUAGE contd…

4.MONITOR COMMANDS:

To enter and execute a program, we have to use **monitor commands**.

- Defining and Determining Locations.
- Editing Programs.
- Listing Program and Location Data.
- Storing, Retrieving and Location Data.
- Program control

VAL SYSTEM AND LANGUAGE contd…

Determining and Defining Locations:

- HERE and POINT command.
- WHERE command is used to display the current location.
- TEACH command is used for recording locations when RECORD button is pressed.

VAL SYSTEM AND LANGUAGE contd…

Editing Programs:

- EDIT command.

Listing Program and Location Data:

- LISTL & LISTP commands.

Storing, Retrieving and Location Data:

- LISTF command.
- STOREP, STOREL and STORE commands.
- LOADP, LOADL and LOAD commands.

VAL SYSTEM AND LANGUAGE contd…

Storing, Retrieving and Location Data:

- In VAL II, an additional command is FLIST.
- Besides VAL and VAL II can accept commands.

COPY

RENAME

DELETE

VAL SYSTEM AND LANGUAGE contd…

Program control:

- SPEED command.
- EXECUTE command.
- ABORT command.
- DRIVE command.
- DO ALIGN command.

VAL SYSTEM AND LANGUAGE contd…

PROGRAM INSTRUCTIONS:

Describes some important instructions included in the program.

- Robot Configuration Control.
- Motion Control.
- Hand Control.
- Location, Assignment and Modification.
- Program Control.

VAL SYSTEM AND LANGUAGE contd…

Robot Configuration Control:

- Execution of next motion of instruction other than a straight line.
- RIGHTY or LEFTY command.
- ABOVE or BELOW command.

VAL SYSTEM AND LANGUAGE contd…

Motion Control:

- MOVE command.
- MOVES command.
- DRAW command.
- APPRO command.
- DEPART command.
- APPROS or DEPARTS commands.
- CIRCLE command.

VAL SYSTEM AND LANGUAGE contd…

Hand Control:

- OPEN and CLOSE commands.
- OPENI and CLOSEI commands.
- CLOSEI 75 in VAL II, if a servo-controlled gripper is used, then this command causes the gripper to close immediately to 75 mm.
- A gripper closing command is also given by GRASP 20, 15

VAL SYSTEM AND LANGUAGE contd…

Hand Control:

- MOVEST PART, 30

Indicates the servo controlled end effector causes a straight line motion to a point defined by the PART and the gripper opening is changed to 30 mm.

VAL SYSTEM AND LANGUAGE contd…

Hand Control:

- MOVET PART, 30

Causes the gripper to move to position, PART with an opening of 30 mm by Joint Interpolated Motion.

VAL SYSTEM AND LANGUAGE contd…

Location, Assignment and Modification:

The instructions that do the same as the corresponding monitor commands

- SET and HERE commands.

VAL SYSTEM AND LANGUAGE contd…

Program Control:

- SETI command sets the value of an integer variable to the result of an expression
- TYPEI displays the name and value of an integer variable.
- GOTO20
- GOSUB and RETURN
- PAUSE

VAL SYSTEM AND LANGUAGE contd…

Program Control:

- PROCEED
- SIGNAL
- IFSIG and WAIT
- RESET

ECONOMICS

- A simple economic analysis assumes that the payback period is given by

$$P = R / (L-M)$$

Where P = payback period in years

R = investment in robot and accessories

L = labor saving per year

M = maintenance and programming cost per year

APPLICATIONS

The robots are used in the following areas:

1.Automotive industry

2.Assembly

3.Medical laboratories

4.Medicine

5.Nuclear energy

APPLICATIONS

The robots are used in the following areas:

6.Agriculture

7.Spatial exploration

8.Under water inspection

9.Customer service

10Arts and environment

REFERENCES

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