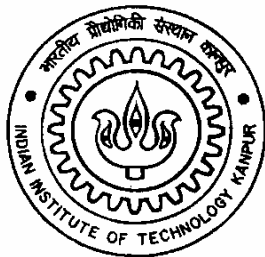

Robot Programming



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Robot task control

- **Teach pendent:** used to manually teach different points that are recorded in the robots memory. These points can then be played back.
 - **Program based control:** The desired task is written as a sequence of motions in a language such as VAL. These motions can then be played back.
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Three generations of programming languages

- ***First generation:*** Simple commands for pick and place operations, with limited interaction with limit switches, stops etc.
- ***Second generation:*** Interaction with the environment using force, touch, ADC/DAC, etc.
- ***Third generation:*** Intelligence capability to understand general commands e.g. 'tighten a nut'

Examples of a few programming languages:

- **VAL** : Victors Assembly Language.
Developed by Unimation for the PUMA robot.
 - **AML** : Developed by IBM for manufacturing automation systems.
 - **RPL** : based on FORTRAN Language.
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Basic commands in VAL II

- **Motion control commands.**
 - **Robot Hand control.**
 - **Program control and input/output control.**
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Motion Control

- POINT P1 = 3, 4, 5, 30, 45, 50
 - MOVE P1
 - MOVES P1
 - DRAW 45, 56, 60
 - APPRO P1 50 (along z axis)
 - DEPART P1 50 (along z axis)
 - APPROX or DEPARTS APPRO or DEPART
-
- CIRCLE P1, P2, P3

Hand Control

- **OPEN and CLOSE**
 - **OPENI and CLOSEI**
 - **CLOSEI 75 in VAL**
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Program Control, Interlock Commands and

- GOTO 20
- GOSUB and RETURN
- IF THEN ELSE
- PAUSE
PROCEED
- SIGNAL
- SIG 2,-3
- WAIT SIG (-1, 2)
- ON 2
- OFF 3
- RESET

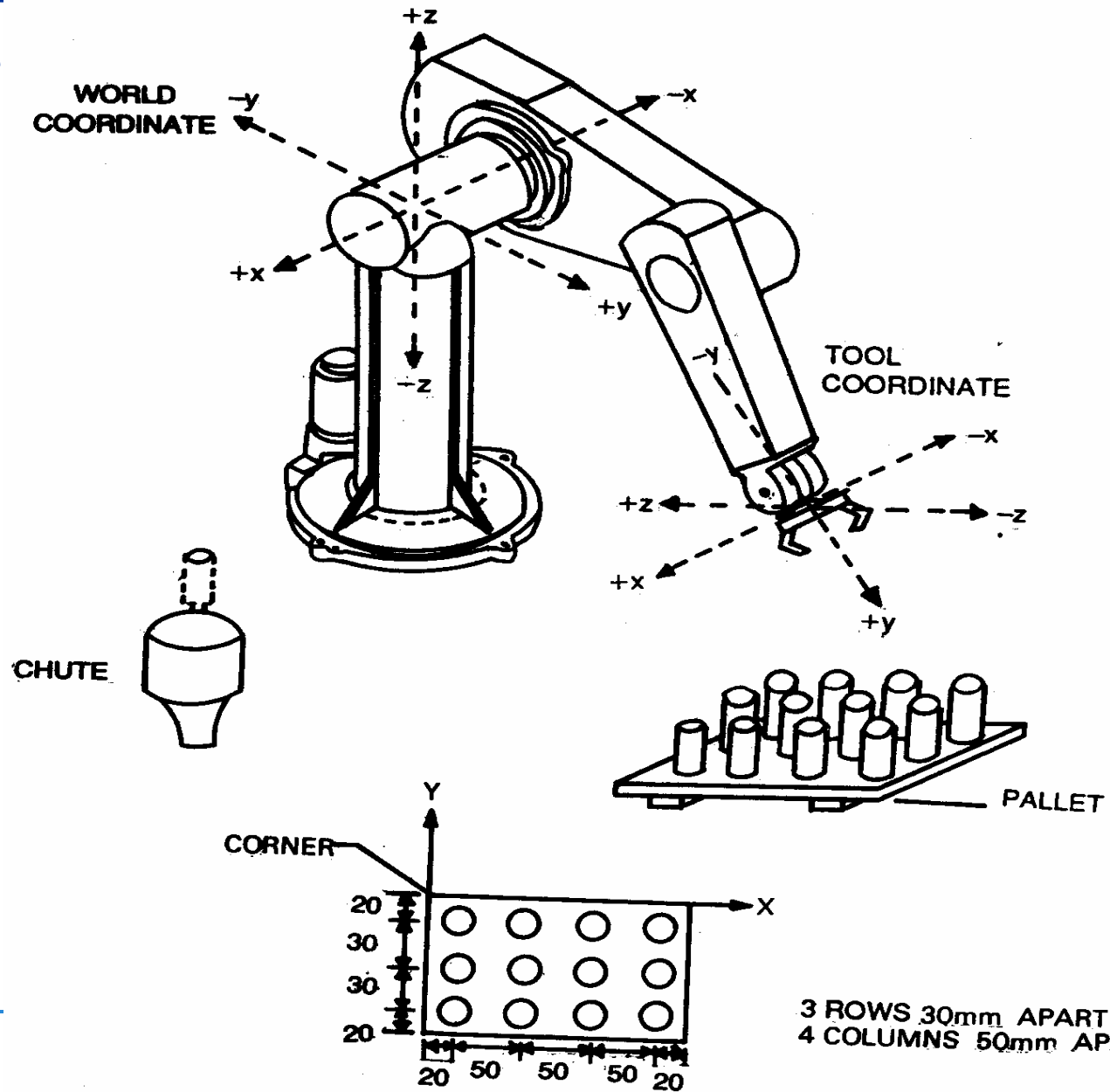
Input / output control

- IOPUT and IOGET
SIGNAL

ADC / DAC

- $DAC1 = SENS1$
 $DAC1 = CONST$
 $DAC1 = 3 + CONST$
 - $VAR\ 1 = ADC(1)$
-

Program example



PROGRAM DEPALLET 1

REMARK CORNER AND CHUTE LOCATIONS ARE TAUGHT

SETI MAXCOL=4

SETI MAXROW=3

SETI ROW =1

SETI COLUMN=1

SET PICK =CORNER

SHIFT PICK BY 20.00,-20.00, 60.00

OPENI

10 MOVE PICK

DRAW 0, 0, - 25.00

CLOSEI

DRAW 0, 0, 25.00

MOVE CHUTE

OPENI

GOSUB PALLET

IF ROW LE MAXROW THEN 10

END

PROGRAM PALLET

SETI COLUMN = COLUMN + 1

IF COLUMN GT MAXCOL THEN 20

SHIFT PICK BY 50.00, 0.00, 0.00

GO TO 10

SETI ROW = ROW + 1

IF ROW GT MAXROW THEN 30

SHIFT PICK BY – 150.00, -30.00, 0.00

END
