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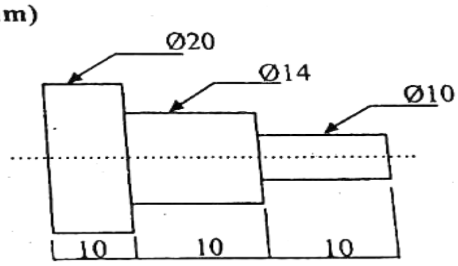
Internal Assessment Test 3 – Dec 2022

Sub	Computer Aided Design & Manufacturing (**CADM**)					Sub Code:	18ME72	Branch	Mech	
Date	26.12.22	Duration	2 PM 3.30 PM	Max Marks	50	Sem / Sec	VII/A&B		OBE	
Answer All Questions								MARKS	CO	RBT

1	**Write Manual Part Program for machining the profile shown in figure (All dimensions are in mm)** 	10	CO4	L3
2	Explain the following terminology related to Robot (i) Accuracy (ii) Resolution (iii) Repeatability	10	CO4	L2
3	Explain the different configurations of robot with neat sketches and explain about various applications areas of industrial robots.	10	CO4	L2
4	Explain with a neat sketch the Sheet lamination process & direct energy deposition technique.	10	CO5	L2
5	Briefly explain about IOT & Cloud computing	10	CO5	L2

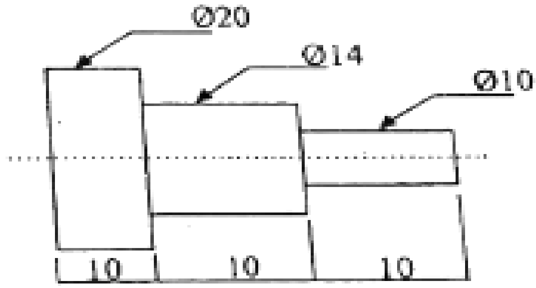
CI **CCI** **HoD**

Computer Aided Design & Manufacturing (CADM)-18ME72

IAT 3 Scheme of Evaluation

Question Number	Particulars	Marks Distribution
1	Part Program	7
	Sketch	3
2	(i) Accuracy with Sketches	4
	(ii) Resolution with Sketches	3
	(iii) Repeatability with Sketches	3
3	Different configurations	3
	Applications	3
	Sketches	4
4	Sheet lamination process	3
	Direct energy deposition technique.	3
	Sketches	4
5	IOT	3
	Cloud computing	3
	Sketches	4

1. Part Program

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N010  G21        G98
N020  G28        U0      W0
N030  M06        T0404
N040  G97        G98     M03    S1200
N050  G00        X21     Z2
'(Box turning cycle)
N060  G90        X20     Z-10   F60
N070  X19
N080  X18
N090  X17
N100  X16
N110  X15
N120  X14
N130  X13
N140  X12
N150  X11
N160  X10
N170  G00        X21     Z-10
N180  G90        X20     Z-20
N190  X19
N200  X18
N210  X17
N220  X16
N230  X14
N240  G00        X21     Z-20
N250  G90        X20     X-30   F60
N260  X19
N270  X18
N280  G28        U0      W0
N290  M05
N300  M30
```

2. The precision with which the robot can move the end of its wrist Spatial resolution, Accuracy & Repeatability. Spatial resolution smallest increment of motion at the wrist end that can be controlled by the robot Depends on the position control system, feedback measurement, and mechanical accuracy

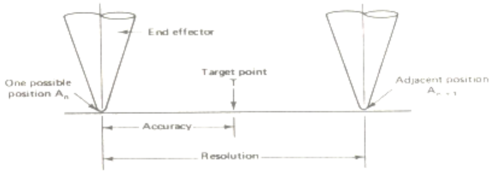


Fig 1.10 Spatial Resolution

Smallest increment of motion

Depends on the control system and feedback

$$\textbf{Control resolution} = \frac{\textbf{range}}{\textbf{Control increments}}$$

Spatial Resolution

Accuracy

Capability to position the wrist at a target point in the work volume

- One half of the distance between two adjacent resolution points
- Affected by mechanical Inaccuracies
- Manufacturers don't provide the accuracy (hard to control)

The ability of a robot to go to the specified position without making a mistake. Closely related to spatial resolution

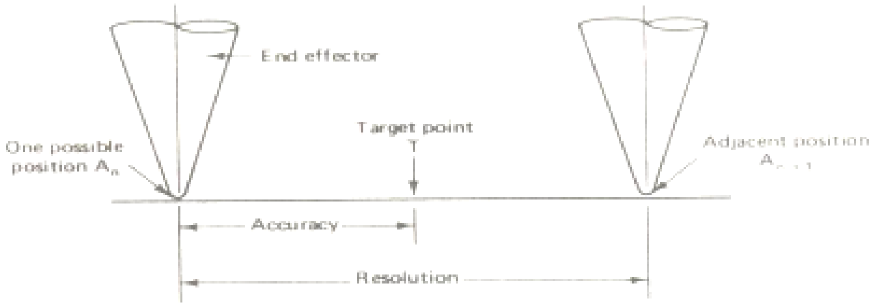


Fig 1.11 Accuracy

Repeatability

Ability to position back to a point that was previously taught

- Repeatability errors form a random variable.
- Mechanical inaccuracies in arm, wrist components
- Larger robots have less precise repeatability values

3.

Classification of robots based on robots configuration

Polar Coordinate Body-and-Arm Assembly

Consists of a sliding arm (L joint) actuated relative to the body, which can rotate about both a vertical axis (T joint) and horizontal axis (R joint) Notation TRL:

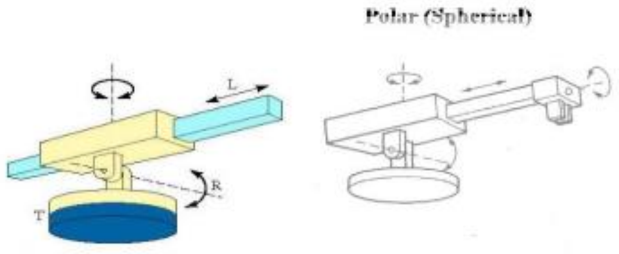


Fig 1.3 Polar Configuration

Cylindrical Body-and-Arm Assembly

Consists of a vertical column, relative to which an arm assembly is moved up or down. The arm can be moved in or out relative to the column Notation TLO:

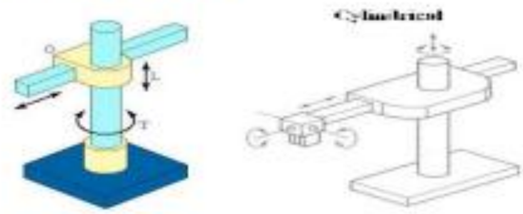


Fig 1.4 Cylindrical Configuration

Cartesian coordinate Body-and-Arm Assembly

Consists of three sliding joints, two of which are orthogonal other names include rectilinear robot and x-y-z robot Notation LOO:

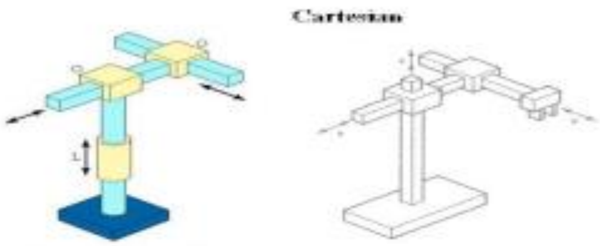


Fig 1.5 Cartesian Configuration

Jointed-Arm Robot

Similar in appearance to human arm Rotated base, shoulder joint, elbow joint, wrist joint.

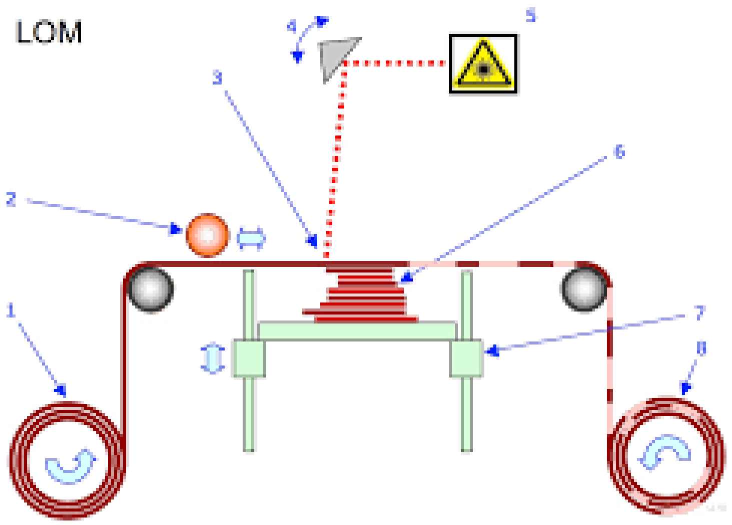
Notation TRR:

Fig 1.6 Jointed Arm Configuration

Application areas of industrial robots has been categorized into the following seven areas.

1. Material Transfer
2. Machine Loading
3. Welding
4. Spray Coating
5. Processing Operations
6. Assembly
7. Inspection

4.



The physical model is formed by stacking layers of sheet
Based on the build material it has two type

- Laminated Object Manufacturing (LOM)
- Ultrasonic Additive Manufacturing (UAM)

LOM uses paper as material and adhesive
UAM used sheets of metal bonded by ultrasonic welding Instead of adhesive

Process steps

1. The sheet and the adhesive is placed on the platform
2. Laser is employed to cut the required shape forms the first layer
3. The spool is rotated for the next layer to position on the first and they are bonded by adhesive heat rolle
4. The required shape is cut by the laser
5. The process repeats till the required thickness is obtained
6. The build is removed to carry the post processing work.

Advantages

1. The process is faster and economical
2. The strength of the part depend on the type of the bond laminated
3. The LOM process does not induce any residual stresses in the finished product

Disadvantages

1. Post processing is required to achieve the desired shape
2. Limitation in variety of material usage
3. This sheet lamination further requires some research

5.

Directed Energy Deposition (DED)

In this process the part is created by melting the Material as it is being deposited

This process is widely used for repair and Maintenance rather than fabricating parts

Laser or electron beam or plasma arc is used As energy source

The metal pool is formed at the when the energy Source is directed over the deposited metal and Solidifies as the beam moves away

Process steps

1. Deposition head is mounted around the fixed object.
2. Material in the wire or powder form deposited by the nozzle
3. Using energy source the material is melted
4. Further material is added layer by layer as it solidifies

Advantages

1. Capable of producing denser parts
2. Utilized effectively for repairing and refurbishing components like turbine blades, crank shafts and bearings

Disadvantages

1. The process is time consuming
2. Components have poor resolution and surface finish
3. Limited material use
4. Further this process requires research

5.

10.6 INTERNET OF THINGS (IoT)

Internet based services are basically a connection of different computers and computing devices. Internet is basically a global network or an internet work of different computers and computing devices. Internet of things (IoT) is the technology that goes beyond connecting computing devices.

The emerging third wave in the development of the internet, the Internet of Things (IoT) is a network of physical objects that can be accessed via the Internet. These objects are everyday items like dishwashers and cars, which contain embedded technology that can interact with an external environment or regulate internal states. Example: A system that plays your favorite TV program as soon as you enter the room.

IoT interconnects different physical objects (things) around us such as the lights, the fans,the air conditioners and anything and everything including things such as the toothbrush,the microwave oven, the refrigerator and the things used in industries and organizations such as machines, equipment's, semi-finished and finished products, conveyors and so on. So, each and everything that around us will be interconnected. To implement such a system these different things will be fitted with embedded systems, embedded electronics and information technology, so that they have some basic computing platform in them. They act as nodes and will be able to communicate with other physical objects (things). IoT is one of the building blocks that is considered to be of use for developing smart factories and smart cities.

10.8.3 Cloud Computing – "The Cloud"

Cloud computing, often called simply "the cloud," involves delivering data, applications, photos, videos, and more over the Internet to data centers. Cloud computing has been broken down into six different categories:

Software as a service (SaaS): Cloud-based applications run on computers off site (or "in the cloud"). Other people or companies own and operate these devices, which connect to users' computers, typically through a web browser.

Platform as a service (PaaS): Here, the cloud houses everything necessary to build and deliver cloud-based applications. This removes the need to purchase and maintain hardware, software, hosting, and more.

Infrastructure as a service (IaaS): IaaS provides companies with servers, storage, networking, and data centers on a per-use basis.

Public Cloud: Companies own and operate these spaces and provide quick access to users over a public network.

Private Cloud: Similar to a public cloud, except only one entity (user, organization, company, etc.) has access.

Hybrid Cloud: Takes the foundation of a private cloud but provides public cloud access.