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Courses » Computer numerical control (CNC) of machine tools and processes

Announcements Course Ask a Question Progress Mentor

Unit 3 - Week2: Technologies and devices employed in CNC machines

Course outline

How to access the portal ?

Week1- Computer Numerical Control Machines : Introduction and Classification

Week2: Technologies and devices employed in CNC machines

- Lecture 07: Stepper motors, Permanent magnet DC motors
- Lecture 08: Binary circuits and decoders
- Lecture 09: Tachogenerator, printed circuit motors, Encoders
- Lecture 10: Programming Practice - I
- Lecture 11: Programming Practice - 11
- Quiz : Assignment-2
- Solution to Assignment-2

Week 3: Computer aided offline programming practice, Linear and curvilinear interpolator, Tutorial

Week 4: 3-D Machining, Curved Surface Geometry and Cutter Path generation, Tutorial

Lecture notes: pdf of all ppts shown

Assignment-2

The due date for submitting this assignment has passed.

Due on 2016-09-23, 22:00 IST.

Submitted assignment

1) Advantage(s) of stepper motor over permanent magnet Direct current (PMDC) motor is / are (within specified operating limits) **1 point**

- No power is required to drive the stepper motor, whereas power is required to drive PMDC motor
- The extent of rotation of output shaft of stepper motor can be controlled precisely without feedback while it is not so in case of PMDC motor
- Stepper motors can rotate in both directions but PMDC motors can only rotate in one direction
- None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

The extent of rotation of output shaft of stepper motor can be controlled precisely without feedback while it is not so in case of PMDC motor

2) A PMDC motor starts up from rest in response to a step voltage V applied across its terminals at time $t=0$. If angular velocity of motor shaft ω is related to V as (k and τ are constants) **1 point**

$$\omega = \frac{V}{k} \left(1 - e^{-\frac{t}{\tau}} \right)$$

- Variation of ω will be sinusoidal with time
- ω will be equal to V/k at steady state ($t = \infty$)
- ω will reach a constant value at $t = \tau$
- None of the others

No, the answer is incorrect.

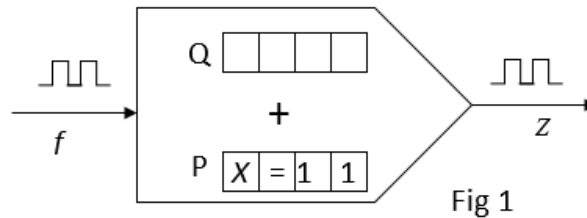
Score: 0

Accepted Answers:

ω will be equal to V/k at steady state ($t = \infty$)

3) A digital differential analyzer (DDA) is getting an input pulse frequency of f Hertz and sending output overflow pulses Z at the rate of 300 Hertz (Fig. 1). It is having 4 bit counters P and Q ($n=4$). The counter shown as P contains a number $X = 3$ (= 11 in binary), which is added repeatedly to the contents of counter Q . **1 point**

If the output overflow pulse rate of the DDA is given by $\frac{f \times X}{2^n}$, the value of f in Hertz is



- 0
 800
 1600
 4800
 None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

1600

4) The CBI (Central Bureau of investigation) has embedded 1 chip each into the bodies of three ATM robbers **P**, **Q** and **R** and has set them free. The chips are emitting continuous wireless signals **p**, **q** and **r** respectively. If a receiver is located within a distance of 1 km of a robber **P**, it will pick up his wireless signal **p** and develop a digital output signal $p_1 = 1$. If it does not pick up the signal, then it develops $p_1 = 0$. The same receiver works simultaneously in the same way for **Q** and **R** and develops similar binary output signals $q_1 = 1$ (if it picks up signal **q**), otherwise $q_1 = 0$ and $r_1 = 1$ (if it picks up signal **r**), otherwise $r_1 = 0$. The CBI needs an ALARM in the form of a digital signal $M = 1$ if at least two of those ATM robbers are together within a radius of 1 km of any particular ATM. In all other cases, $M = 0$. All ATMs are equipped with receivers. M can be obtained as the output of the following digital circuit, if it be posted at each ATM with p_1 , q_1 and r_1 as inputs:

("+" stands for logic OR operation and "." stands for logic AND operation)

- $p_1 + q_1 + r_1$
 $p_1 \cdot q_1 \cdot r_1$
 $p_1 \cdot q_1 + q_1 \cdot r_1 + p_1 \cdot r_1$
 None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

$p_1 \cdot q_1 + q_1 \cdot r_1 + p_1 \cdot r_1$

5) Milling operation is taking place on a CNC milling machine. From the signals received from a grey code absolute encoder mounted on the rotating lead screw of the X-axis feed drive of the CNC milling machine, it is possible to

- Detect whether upmilling / downmilling is taking place
 Detect the direction of rotation of the lead screw of the X-axis feed drive
 Detect the direction of rotation of cutter
 None of the others detections are possible

No, the answer is incorrect.

Score: 0

Accepted Answers:

Detect the direction of rotation of the lead screw of the X-axis feed drive

6) Holes have to be drilled on the part shown, with equi-angular spacing on the circumference of a circle about the centre C (Fig. 2) on a CNC drilling machine having an X-Y table. The drill is mounted on the vertical drill spindle by automatic tool changing and the workpiece is placed on the X-Y table whose movements are programmable in X and Y

axes. Drilling has to be carried out by CNC program execution and no manual intervention is permitted. In such a case

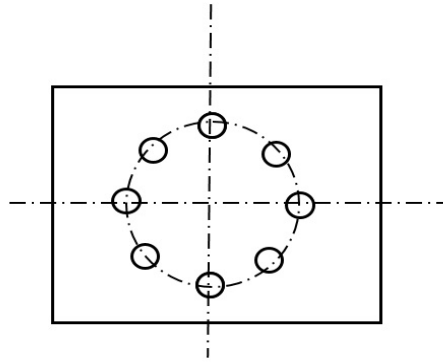


Fig. 2 X-Y Plane

- CNC circular interpolation is necessary
- The programmable X-Y table is sufficient for taking the drill to all hole locations
- The programmable X-Y table is not sufficient and a CNC rotary table is necessary
- None of the others
- An indexing head is necessary

No, the answer is incorrect.

Score: 0

Accepted Answers:

The programmable X-Y table is sufficient for taking the drill to all hole locations

7) A recirculating ball screw-nut mechanism is used in the feed drive of a CNC continuous control system for 1 point

- Reducing machining time
- Eliminating or reducing backlash in lead screw-nut pairs
- Increasing cutting speed
- None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

Eliminating or reducing backlash in lead screw-nut pairs

8) In a remote controlled wheeled robot for defusing of bombs, a stepper motor is employed for getting rotation of 1 point the wheels. The wheels rotate at speeds of 5 rpm, 2.5 rpm and 1.25 rpm due to a 2000 ppm pulse train input to a DDA which gives pulse output Z to the stepper motor driver. To get a particular speed of stepper motor shaft, the remote controller has option to upload any one of three fixed numbers (which can only be positive integers) into the DDA p counter (Fig. 3). Given - one angular step of motor takes place for one pulse and 200 angular steps making one rotation of motor shaft. In such case, the minimum number of bits p counter should have is

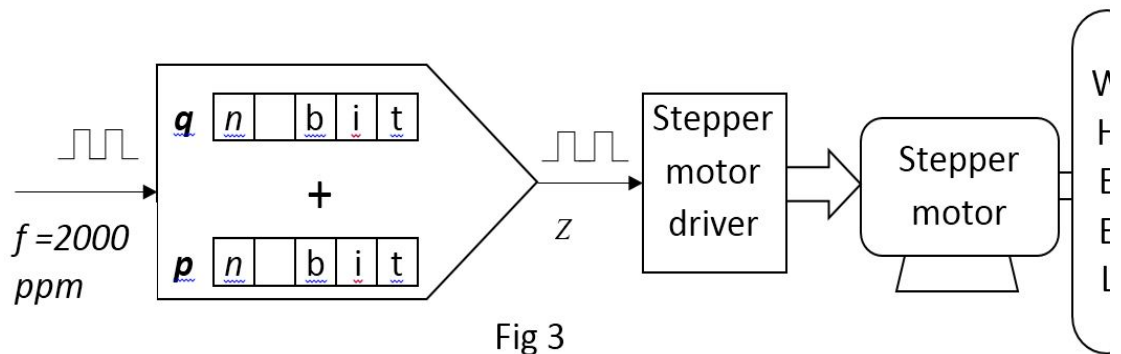


Fig 3

- 4
- 3
- 2
- 8
- None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

3

9) In CNC milling, the length of cutter protruding from spindle and the height of the part above table surface can be made known to the machine controls by **1 point**

- Declaration of cutter diameter offset
- Declaration of Mirror imaging command
- Declaration of cutter length offset
- None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

Declaration of cutter length offset

10) In printed circuit motor, the polar moment of inertia is reduced by **1 point**

- Using and electronic control circuit on PCB (printed circuit board) inside the motor which electronically reduces moment of inertia
- Replacing the rotor (which has heavy copper coils) by a thin, disc shaped permanent magnet rotor
- Replacing the rotor (which has heavy copper coils) by a plastic armature with aluminium wires replacing heavy copper coils
- None of the others

No, the answer is incorrect.

Score: 0

Accepted Answers:

Replacing the rotor (which has heavy copper coils) by a plastic armature with aluminium wires replacing heavy copper coils

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