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NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Robotics and Control: Theory and Practice (course)

Announcements (announcements) **About the Course (https://swayam.gov.in/nd1_noc20_me03/preview)**

Ask a Question (forum) Progress (student/home) Mentor (student/mentor)

Unit 5 - Week 4

Course outline

How does an NPTEL online course work?

Week 1

Week 2

Week 3

Week 4

- Manipulator Control (unit?unit=57&lesson=68)
- Biped Robot Basics and Flat Foot Biped Model (unit?unit=57&lesson=69)
- Biped Robot Flat Foot and Toe Foot Model (unit?unit=57&lesson=70)

Assignment 4

The due date for submitting this assignment has passed. **Due on 2020-02-26, 23:59 IST.**

Assignment submitted on 2020-02-15, 17:25 IST

1) Consider dynamic equation given by: ***1 point***

$m\ddot{x} = f$, where m denotes mass , x denotes displacement and f denotes force.

If m=1 unit, $x_d(t) = const.$ is the desired trajectory, and error

$e = x - x_d \quad If \quad we \quad apply \quad P.D. \quad control \quad f = Ke + L\dot{e}$

,then resulting trajectory is asymptotically stable when:

- $L > 0 \quad and \quad L^2 + 4K < 0$
- $L < 0 \quad and \quad L^2 + 4K < 0$
- (selected) $L > 0 \quad and \quad L^2 + 4K > 0$
- $L < 0 \quad and \quad L^2 + 4K > 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$L < 0 \quad and \quad L^2 + 4K < 0$

2) Dynamic equation on one arm manipulator with mass M, torque τ joint angle θ and length L is ***1 point***
given by:

- Artificial Neural Network (unit?unit=57&lesson=71)
- Neural Network based control for Robot Manipulator (unit?unit=57&lesson=73)
- **Quiz : Assignment 4 (assessment?name=84)**
- Solution For Assignment 4 (unit?unit=57&lesson=93)

Week 5

Week 6

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WEEKLY FEEDBACK

$\frac{1}{3}ML^2\ddot{\theta} + \frac{Mg}{2}Lsin\theta = \tau$

If θ_d denotes desired trajectory, and the error is given by:

$e = \theta - \theta_d$

If we apply P.D control:

$\tau(t) = \frac{Mg}{2}Lsin(e + \theta_d) - \frac{ML^2}{3}[-Ke - L\dot{e}]$

Then resulting trajectory is asymptotically stable when:

- $L^2 - 4K > 0$
- $L^2 - 4K \leq 0$
- $L^2 - 4K < 0$
- $L^2 - 4K \geq 0$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$L^2 - 4K < 0$

3) If a biped robot is walking in x-direction and z-direction is vertical then: ***1 point***

- x-z is frontal plane
- x-z is sagittal plane
- x-z is transverse plane
- x-y is sagittal plane

Yes, the answer is correct.
Score: 1

Accepted Answers:
x-z is sagittal plane

4) In case of a person running fast: ***1 point***

- There is no Single Support Phase.
- There are both single support Phase and double support phase..
- There is only double support Phase.
- There is no double support Phase.

No, the answer is incorrect.
Score: 0

Accepted Answers:
There is no double support Phase.

5) Zero Moment Point for a stable walk should lie: ***1 point***

- Between hips in single support phase.
- Below stable leg in single support phase.
- Below swing leg in single support phase.
- Anywhere outside support region in single support phase.

Yes, the answer is correct.
Score: 1

Accepted Answers:
Below stable leg in single support phase.

6) Which of the following is not a sigmoid function? ***1 point***

- $\frac{1}{1+e-x}$
- e^{-x}
- $\frac{e^x-e^{-x}}{e^x+e^{-x}}$
- $\frac{x}{\sqrt{1+x^2}}$

Yes, the answer is correct.
Score: 1

Accepted Answers:
e^{-x}

7) For a neural network with *n* input, *m* output with *l* neurons in hidden layer; equation for output y in terms of input x with weights u_{ij} and v_{jk} for input to hidden layer and hidden to output layer respectively can be given by: ***1 point***

- $\sum_{j=1}^{l} v_{jk}\sigma[\sum_{i=1}^{n} u_{ij}x_i]; k = 1, 2, \dots m$
- $\sum_{j=1}^{l-1} v_{jk}\sigma[\sum_{i=1}^{n-1} u_{ij}x_i]; k = 1, 2, \dots m$
- $\sum_{j=1}^{n} v_{jk}\sigma[\sum_{i=1}^{l} u_{ij}x_i]; k = 1, 2, \dots m$
- $\sum_{j=1}^{n-1} v_{jk}\sigma[\sum_{i=1}^{l-1} u_{ij}x_i]; k = 1, 2, \dots m$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$\sum_{j=1}^{l} v_{jk}\sigma[\sum_{i=1}^{n} u_{ij}x_i]; k = 1, 2, \dots m$

8) Consider a neural network as in (7) with one input, two hidden neurons and one output. If the input x=1, output y=5 , logistic function as the transfer function with learning rate $\alpha = 0.1$,then weights $\begin{pmatrix} v_{11} \\ v_{21} \\ u_{11} \\ u_{12} \end{pmatrix}$ after first iteration using gradient descent will be (consider null weights initially): ***1 point***

- $\begin{pmatrix} 1 \\ 1 \\ 0 \\ 0 \end{pmatrix}$

- [x] $\begin{pmatrix} 0.5 \\ 0.5 \\ 0 \\ 0 \end{pmatrix}$
- [ ] $\begin{pmatrix} -1 \\ -1 \\ 0 \\ 0 \end{pmatrix}$
- [ ] $\begin{pmatrix} -0.5 \\ -0.5 \\ 0 \\ 0 \end{pmatrix}$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$\begin{pmatrix} 0.5 \\ 0.5 \\ 0 \\ 0 \end{pmatrix}$

9) Which of the following hold true for a n arm manipulator whose dynamic equation is: **1 point**
$M(q)\ddot{q} + V(q,\dot{q})\dot{q} + G(q) + F_r(\dot{q}) + T_d = \tau$
with symbols have their respective meanings?

- [x] $(1/2\dot{M}(q) - V(q,\dot{q}))$ is skew symmetric.
- [ ] $(1/2M(q) - V(q,\dot{q}))$ is skew symmetric.
- [ ] $(1/2M(q) + V(q,\dot{q}))$ is skew symmetric.
- [ ] $(1/2\dot{M}(q) + V(q,\dot{q}))$ is skew symmetric.

Yes, the answer is correct.
Score: 1

Accepted Answers:
$(1/2\dot{M}(q) - V(q,\dot{q}))$ *is skew symmetric.*

10) Pseudo inverse of matrix $\begin{bmatrix} 1 & 2 \end{bmatrix}$ is given by: **1 point**

- [ ] $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$
- [ ]

$\begin{bmatrix} 2 \\ 1 \end{bmatrix}$

$5\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

$1/5\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

Yes, the answer is correct.
Score: 1

Accepted Answers:

$1/5\begin{bmatrix} 1 \\ 2 \end{bmatrix}$