Quizzes of TTK4225 - Systems Theory, Autumn 2020

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Question 91

The zeros of a transfer function affect the stability properties of that system

1. true
2. false
3. it depends on the system
4. I do not know

Question 92

The zeros of a transfer function affect the transient of the step response of that system

1. true
2. false
3. it depends on the system
4. I do not know

Question 93

The number of zeros of a rational transfer function modelling a physical system cannot be bigger than the number of poles

1. true
2. false
3. it depends on the system
4. I do not know

Question 94

The number of zeros of a rational transfer function cannot be bigger than the number of poles

1. true
2. false
3. it depends on the system
4. I do not know

Question 95

When designing a LTI controller, it may be meaningful to design the zeros of a transfer function so to improve the overall response of the closed-loop system

1. true
2. false
3. it depends on the system
4. I do not know

Question 96

The convolution of a rectangular signal with itself leads to . . .

1. another rectangle
2. a triangle
3. a trapezoid
4. it depends on the length of the rectangle
5. I do not know

Question 97

Convolution is a nonlinear operator

1. true
2. false
3. it depends on the actual signals that are convolved
4. I do not know

Question 98

Compute the equilibria of the system

$$\dot{x} = f(x) = x^2 - 2x - 3$$

Question 99

Compute the equilibria of the system

$$\dot{\boldsymbol{x}} = \begin{bmatrix} f_1(\boldsymbol{x}) \\ f_2(\boldsymbol{x}) \end{bmatrix} = \begin{bmatrix} x_2 \\ 1 - x_1^2 - x_2 \end{bmatrix}$$

Question 100

Consider the dynamics $\dot{y} = y^2$, and the trajectory corresponding to $y_0 = c$, given by

$$y(t) = \frac{c}{1 - t}.$$

This solution ...

1. is bounded
2. diverges to $+\infty$
3. presents a finite escape time
4. I do not know

Question 101

Autonomous nonlinear systems $\dot{y} = f(y)$ are such that it is always possible to exponentially bound their trajectories, i.e., find α and β such that $\|y(t)\| \leq \alpha e^{\beta t}$ (with α and β potentially depending on the initial condition y_0)

1. is bounded
2. diverges to $+\infty$
3. presents a finite escape time
4. I do not know

Question 102

The following definition of simple stability is correct:

<u>$\boldsymbol{y}_{\text{eq}}$ is simply stable if $\forall \delta > 0 \; \exists \varepsilon > 0$ s.t. if $\|\boldsymbol{y}_0 - \boldsymbol{y}_{\text{eq}}\| \leq \delta$ then $\|\boldsymbol{y}(t) - \boldsymbol{y}_{\text{eq}}\| \leq \varepsilon \quad \forall t \geq 0$</u>

1. true
2. false
3. it depends
4. I do not know

Question 103

The following definition of simple stability is correct:

$\underline{\boldsymbol{y}_{\text{eq}} \text{ is simply stable if } \exists \varepsilon > 0 \ \forall \delta > 0 \text{ s.t. if } \|\boldsymbol{y}_0 - \boldsymbol{y}_{\text{eq}}\| \leq \delta \text{ then } \|\boldsymbol{y}(t) - \boldsymbol{y}_{\text{eq}}\| \leq \varepsilon \quad \forall t \geq 0}$

1. true
2. false
3. it depends
4. I do not know

Question 104

The following definition of simple stability is correct:

$\underline{\boldsymbol{y}_{\text{eq}} \text{ is simply stable if } \forall \varepsilon > 0 \; \exists \delta > 0 \text{ s.t. if } \|\boldsymbol{y}_0 - \boldsymbol{y}_{\text{eq}}\| \leq \varepsilon \text{ then } \|\boldsymbol{y}(t) - \boldsymbol{y}_{\text{eq}}\| \leq \delta \quad \forall t \geq 0}$

1. true
2. false
3. it depends
4. I do not know

Question 105

The origin is always an equilibrium for a LTI system of the type $\dot{\boldsymbol{y}} = A\boldsymbol{y} + B\boldsymbol{u}$.

1. true
2. false
3. it depends
4. I do not know

Question 106

The origin is always an equilibrium for a generic system of the type $\dot{\boldsymbol{y}} = \boldsymbol{f}(\boldsymbol{y}, \boldsymbol{u})$.

1. true
2. false
3. it depends
4. I do not know