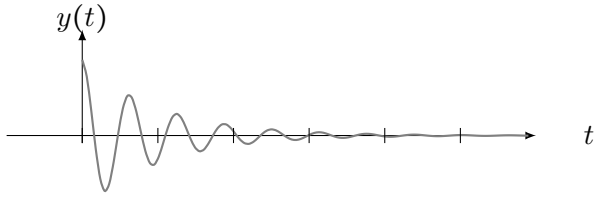
Quizzes of TTK4225 - Systems Theory, Autumn 2020

Damiano Varagnolo

Question 44

May the evolution $y(t)$ given by



correspond to the free evolution of a first order LTI system? And to its forced evolution?

1. yes, yes
2. yes, no
3. no, yes
4. no, no
5. I do not know

Question 45

Transforming the ODE

$$\dddot{y} = 0.3\ddot{y} - 0.1\dot{y} + 1.4y + \dot{u} - 0.1u$$

into a state space system $\dot{\boldsymbol{x}} = A\boldsymbol{x} + B\boldsymbol{u}$, $y = C\boldsymbol{x}$ leads to a matrix A of dimensions

1. 2×2
2. 3×3
3. 4×4
4. 5×5
5. I do not know

Question 46

Transforming the ODE

$$\dddot{y} = 1.4y + \dot{u}$$

into a state space system $\dot{\boldsymbol{x}} = A\boldsymbol{x} + B\boldsymbol{u}$, $y = C\boldsymbol{x}$ leads to a matrix A of dimensions

1. 2×2
2. 3×3
3. 4×4
4. 5×5
5. I do not know

Question 47

Transforming the ODE

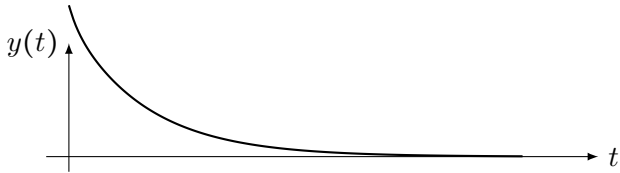
$$\dddot{y} = 1.4y + \dot{u}$$

into a state space system $\dot{\boldsymbol{x}} = A\boldsymbol{x} + B\boldsymbol{u}$, $y = C\boldsymbol{x}$ leads to a matrix B of dimensions

1. 2×2
2. 3×2
3. 3×3
4. 4×3
5. I do not know

Question 48

The following evolution



corresponds to a situation where the system is ...

1. damped
2. underdamped
3. overdamped
4. I do not know

Question 49

The following evolution

corresponds to a situation where the system is ...

1. damped
2. underdamped
3. overdamped
4. I do not know

Question 50

All the different types of Laplace transforms are defined as an integral ranging from 0 to $+\infty$

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

Question 51

How would one Laplace-transform the ODE $\dddot{y} = \dot{y} + u$, assuming that all the initial conditions are 0?

1. $s^{-3}Y = s^{-1}Y + U$
2. $s^{3}Y = sY + U$
3. I do not know

Question 52

To what does $\frac{1}{s}$ correspond, from an intuitive perspective, if we consider Laplace transforms of continuous time signals?

1. a derivative
2. an integrator
3. a multiplication in frequency
4. I do not know

Question 53

The usefulness of the Laplace transform to solve ODEs of linear systems is that ...

1. it casts the problem in the frequency domain
2. it transforms the problem into an algebraic one
3. it enables using pre-compiled tables of known Laplace transforms
4. I do not know

Question 54

What is the region of convergence of the Laplace transform of e^{at}?

1. $\mathrm{Re}[s] < 0$
2. $\mathrm{Re}[s] < a$
3. $\mathrm{Re}[s] > 0$
4. $\mathrm{Re}[s] > a$
5. I do not know

Question 55

What is the time constant associated to the system whose Laplace transform of the impulse response is $\frac{1}{s-3}$?

1. 3
2. 1/3
3. undefined
4. I do not know

Question 56

What is the time constant associated to the system whose Laplace transform of the impulse response is $\frac{1}{s+3}$?

1. 3
2. 1/3
3. undefined
4. I do not know

Open exercise

Transform the ODE

$$\dddot{y} = 0.3\ddot{y} - 0.1\dot{y} + 1.4y + \dot{u} - 0.1u$$

into a state space system $\dot{\boldsymbol{x}} = A\boldsymbol{x} + B\boldsymbol{u}$, $y = C\boldsymbol{x}$.