University of Djelfa

Faculty: Sciences & Technology
Departemnt: Electrical Engineering
Exam.: Nonlinear Systems (2023/24)
Duration: 01H30, Documents allowed

Exercise 01 1st style: Answers on separate sheet

Let's consider the nonlinear system: $\begin{cases} \dot{x}_1 = x_1^2 - x_1 x_2 \\ \dot{x}_2 = x_1^3 - x_2 \end{cases}$

1. Compute the equilibrium points of this system. (2 ½)

2. Determine the nature of each equilibrium point. (2)

3. Linearize the model of the system around each equilibrium point. (2)

Exercise 02 2nd style: Answers on the same sheet

1. For x, y, z and n positive integers, show that $x^n + y^n = z^n$.

2. Prove that the real part of all non-trivial zeros of the function $\zeta(z)$ is $\frac{1}{2}$

3. Compute the following quantity
$$\int_0^\infty \frac{\sin(x)}{x}$$

Exercise 03 3rd style: questions with subparts

1. Show that the equation $x^n + y^n = z^n$ has a solution for x, y, z and n positive integers.

   (a) Determine the values of n according to the previous question?

   (b) If $n = 2$ show that the previous equation has a double solution.

   (c) Who is the first scientist established this equation

      i. Who actually proved the theorem?

      ii. How long did actually take to solve this problem?

2. Prove that the real part of all non-trivial zeros of the function $\zeta(z)$ is $\frac{1}{2}$

Exercise 04 4th style: multiple choice and answers on the same sheet

1. Which of these persons discoverd the water composition?

   A. Ibn khaldoun   B. Ibn elhaithem   C. El farabi   D. None of the above

2. Which of these persons was president of Algeria?

   ○ Houari Boumedienne
   ○ Elyamine zeroual
   ○ Kawther Zerogui
   ○ I don't know