Universitatea Babeş-Bolyai, Facultatea de Matematică şi Informatică
Secţia: Informatică engleză, Curs: Dynamical Systems, Semestru: Primăvara 2021

Dynamical Systems 2020/21
Lab Test

1. Find the solution of the following IVP, then plot its graph on the interval $[1, 4.4]$, and finally compute an approximate value of it in 0. The unknown is the function denoted by $v(x)$. By e below we denote the Euler's number.

$$v'' - 16v = 0,\ v(e) = v'(e) = 1.$$

2. a) Plot the planar curve of parametric equations $x = \sin(t)$, $y = \sin(2t)$ for $t \in [0, 10]$.
   b)* Can $\varphi(t) = (\sin(t), \sin(2t))$, $t \in \mathbb{R}$, be a solution of a linear planar system $\dot{X} = AX$?

3. Introduce the matrix A corresponding to the linear system $x' = -7x,\ y' = x + 7y$. Compute its determinant and eigenvalues. Compute e^{tA}. Specify the type and stability of the linear system.

4. We consider the nonlinear system $x' = -17y + 3y^2 - 2xy,\ y' = 17x + xy$. Is $(0, 0)$ the unique equilibrium point? Is $(0, 0)$ a hyperbolic equilibrium point?

5. We consider the map $f : \mathbb{R} \to \mathbb{R}$, $f(x) = 0.02x(100 - x)$. Find its fixed points. Describe your opinion on the behavior of the sequence of iterations starting with 10, 80 and, respectively, 95.