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 a polynomial solution of the differential equation

$$u'' + 5u' - 7u = x^2 + 5x - 7,$$

then plot its graph on the interval $[-10, 5]$, and finally compute, for it and for its first order derivative, approximate values in $\pi\sqrt{2}$. Note that the unknown is the function denoted by $u(x)$.

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 $x' = x - 17y + 3y^2 - 2xy,\ y' = 17x + y$. 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.