Nonlinear Dynamics, Spring 2019 CMI

Problem set 1

Due at the beginning of lecture on Thursday Jan 17, 2019

Non-autonomous systems, Linear stability in 1d

1. $\langle \mathbf{4} \rangle$ Consider the forced oscillator equation $m\ddot{x} + \gamma\dot{x} + kx = f\cos t$ for positive constants m, γ, k and real constant f. Is it linear or non-linear, of what order and homogeneous/inhomogeneous? Write it as an autonomous system of first order ODEs. Is the system linear or nonlinear?

2. $\langle \mathbf{6} \rangle$ Here we consider linear stability analysis for the fixed points of the overdamped driven pendulum $\dot{\theta} = \omega - a\sin\theta$ when $a > \omega > 0$. How many qualitatively different fixed points are there and where are they located? Find the growth/decay time scales by linearizing the vector field in the neighbourhood of the fixed points (only the qualitatively distinct ones).