

MATLAB.5

Read Chapter 7 in Polking.

ASSIGNMENT 5 :

1. Use ode45 to solve the initial value problem

$$x'' - x'/t + (4t^2)x = 0 \quad \text{where } x=x(t) \quad , \quad 1 < t < 3$$

and

$$x(1)=1, \quad x'(1)=3. \quad (\text{Look at page 89.})$$

Plot $x(t)$ on the interval.

2. Predator-Prey Problem

a) During the 1st World War fisherman noticed a larger percentage of their catch was sharks

and other fish eating fish than was true before or after the war.

Let $x=x(t)$ denote the population of prey and $y=y(t)$ the population of predators. From section

9.6 in B&D we can use the model

$$(1) \quad \begin{aligned} x' &= a*x - b*x*y, \\ y' &= -c*y + d*x*y \end{aligned}$$

for some positive constants. Solve this with $a=0.4, b=0.01, c=0.3, d=0.005$ and initial conditions $x(0)=50, y(0)=30$ for $0 < t < 100$.

Plot x versus t, y versus t , and a x versus y phase plane plot. You can use either ode45 or pplane for this.

b) The system (1) does not take fishing into account. If you fish you catch both x and y and the model becomes

$$(2) \quad \begin{aligned} x' &= a*x - b*x*y - e*x, \\ y' &= -c*y + d*x*y - e*y \end{aligned}$$

for some constant e . Solve (2) with the same a, b, c, d and initial conditions as before for

$e = 0, 0.01, 0.02, 0.03, \text{ and } 0.04$. Plot the 5 solutions on the same phase plane ($x-y$)

and label them properly. You will have to use ode45 for this (solve the 5 initial value

problems and plot them on the same graph).

c) Can you use the plot from b) to explain why more sharks were caught during WWI ?

You can assume there was less fishing during the war.