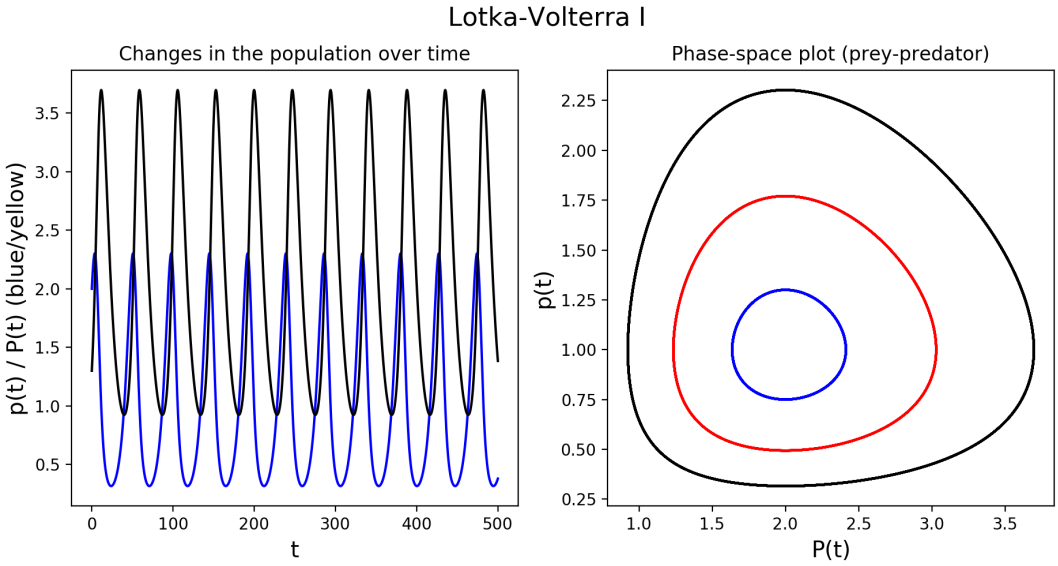
Lotka-Volterra model

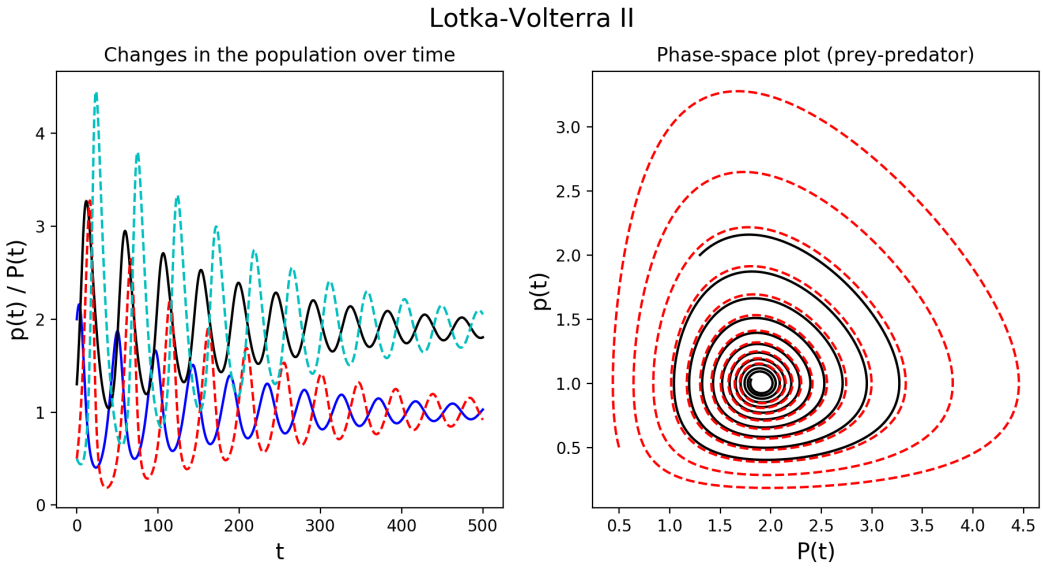
Abstract

The Lotka-Volterra model is describing predator-prey like interactions. It has few different variations, from the simplest one describing only the change of populations of prey and predator without any realistic modifications to a more complex one, where there can be even more predators sharing the same prey. Basically, it describes biological systems and neural networks, but it has even applications in fusion plasma physics to try to understand the behaviour of turbulence and its interactions occuring in Tokamaks. With this motivation the results of the given three different variations [1] will be discussed. The phase transitions will be also examined thoroughly and be related to Limit-Cycle-Oscillations (LCO) and L-H transitions. A 4th-order Runge-Kutta explicit solver will be applied and the obtained result will be validated through the examples given in the book [1] and through some other sources.

References

[1] Rubin H Landau, Manuel J Paez, Cristian Bordeianu: A Survey of Computational Physics - Introductory Computational Science, Princeton University Press, 2008.


Lotka-Volterra I
Changes in the population over time
p(t) / P(t) (blue/yellow)
t
Phase-space plot (prey-predator)
p(t)
P(t)


Lotka-Volterra II
Changes in the population over time
p(t) / P(t)
t
Phase-space plot (prey-predator)
p(t)
P(t)