The Lotka-Volterra Predator-Prey Model and Harvesting Strategies

LIXIAN CHEN
CALIFORNIA STATE UNIVERSITY SAN MARCOS

Abstract:

In this talk, I will first briefly describe the basics of the classical Lotka-Volterra predator-prey model, and then discuss the predator-prey model modified with logistic growth of the prey. I will further introduce the modified predator-prey model with harvesting of the prey. Different types of harvesting will be briefly introduced, with focus on the easiest type -- harvesting with constant harvest rate. To numerically approximate the solutions of the predator-prey system with different variations, the explicit Runge-Kutta method has been used. In particular, the Runge-Kutta-Fehlberg method with stepwise control and the Dormand-Prince coefficients are used for better approximation. Investigation of the qualitative behavior of the solutions and the stability analysis of the predator-prey model with harvesting of the prey requires techniques of linearization, scaling, change of variables, etc., commonly used for the study of nonlinear ordinary differential equations. Specifically, we vary the harvest rate in the model and study the change of the equilibrium points, the cycle, the yield of a cycle and the average yield. The results of the linearized system can be determined and proven, and we make conjectures of similar results for the original nonlinear system. We start with the analysis for the most basic and simple type of system, and extend to the study of other variations of the predator-prey model with harvesting.