

GLOBAL DYNAMICS OF A THREE DIMENSIONAL DISCRETE LOTKA-VOLTERA MODEL

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Abstract.

This manuscript studies the behavior of following predator prey model in three dimension

$$x_{n+1} = \frac{\alpha_1 y_n}{\beta_1 + \gamma_1 x_{n-1}}, \quad y_{n+1} = \frac{\alpha_2 z_n}{\beta_2 + \gamma_2 y_{n-1}}, \quad z_{n+1} = \frac{\alpha_3 x_n}{\beta_3 + \gamma_3 z_{n-1}}, \quad n = 0, 1, 2, \dots \quad (1)$$

Where $\alpha_1, \beta_1, \gamma_1, \alpha_2, \beta_2, \gamma_2, \alpha_3, \beta_3, \gamma_3 \in (0, \infty)$ and the initial conditions

$$x_{-1}, x_0, y_{-1}, y_0, z_{-1}, z_0 \in (0, \infty).$$

We investigate the local asymptotic and global stability and convergence rate of positive solution about equilibrium point (EP) of system (1) (S1). At the end some numerical simulations are given to satisfy the theoretical discussion.

Keywords. difference equation, periodicity, global stability, boundedness.

1 Introduction

Difference equations (DE) are used as mathematical modeling in physical and economical models. DE is a vast field which impact almost found in applied and pure mathematics. Recently great interest is developed in studying DE systems. The reason is that there is a need of some techniques which can be used in investigating problems in various fields. Recently a great work is being done in studying the qualitative analysis of rational DEs. There are many papers that can be easily found comprising on significance and applications of DEs, see [1,2,3,4,5,9,10]. The study of qualitative analysis of DE is very important. However DEs are extensively used in Physics, Economics and Biological sciences. Qualitative behavior includes global attractivity, bounded character and periodicity. The investigation of DEs of higher order is very demanding and important. There is not any effective method to cope with the global behavior of higher