MATHEMATICAL ANALYSIS OF ANTAGONISTIC POPULATIONS WITH THE MODEL VOLTERRA-LOTKA

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Introduction. The mathematical model of Volterra is often used in the analysis of the development of antagonistic populations in the "predator-prey" regime. Its differential equations are follows:

$$\frac{d}{dt}x = a1 \cdot x - b1 \cdot x \cdot y \quad \frac{d}{dt}y = -a2 \cdot y + b2 \cdot x \cdot y.$$

This model works well when there is no competition between individuals inside the population. In such cases, an undamped oscillatory process arises (Fig. 1).

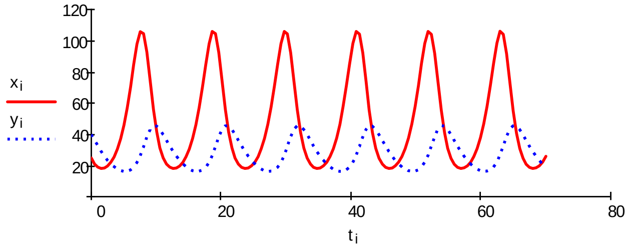

Fig. 1

Aim. Make analysis of the development process, which describes process, when is no competition between individuals inside the population.

Materials and methods. If populations develop in conditions of tightness and lack of food, then in the equations this is displayed by changing the coefficients before the first terms on the side. These coefficients determine the rate of population growth. In the equations given below, the magnitude of these coefficients decreases with the growth of the population. This model is called the Volterra-Lotka model and it is as follows:

$$\frac{d}{dt}x = (a1 - ñ1 \cdot x) \cdot x - b1 \cdot x \cdot y \quad \frac{d}{dt}y = -(a2 + c2 \cdot y) \cdot y + b2 \cdot x \cdot y.$$

Results and discussion. After a certain of time, the population becomes constant (Fig. 2).The effect of all coefficients in the system of Volterra-Lotk equations on the development of populations is analyzed. Set their critical values that determine the development and extinction of populations and the nature of the process that can be oscillatory or aperiodic.

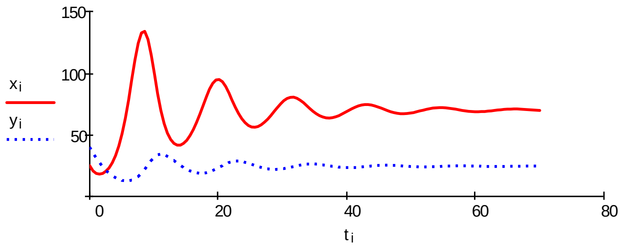

Fig. 2