



PROCEEDINGS BOOK

**MAS 19th
INTERNATIONAL EUROPEAN CONFERENCE
ON MATHEMATICS, ENGINEERING, NATURAL
& MEDICAL SCIENCES**

April 17-18, 2024

Mingachevir State University, Mingachevir, Azerbaijan

EDITOR:

Prof. Dr. Veysel EYYUBOV



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PHASE-SPACE ANALYSIS OF TUMOR GROWTH WITH AN IMMUNE RESPONSES

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Abstract

We present a phase-space analysis of a mathematical model of tumor growth with an immune responses. We consider mathematical analysis of the model equations with multipoint initial condition regarding to dissipativity, boundedness of solutions, invariance of non-negativity, local and global stability and the basins of attractions. We derive some features of behavior of the three-dimensional tumor growth models with dynamics described in terms of densities of three cells populations: tumor cells, healthy host cells and effector immune cells. We found sufficient conditions, under which trajectories from the positive domain of feasible multipoint initial conditions tend to one of equilibrium points. Here, cases of the small tumor mass equilibria-the healthy equilibrium point, the "death" equilibria have been examined. Biological implications of our results are discussed.

Beginning with this article we intend to investigate the problems of mathematical and biological approaches to model the cancer growth dynamics processes and operations. It is important to take into account "the nonlinear property of cancer growth processes" in construction of mathematical logistic models. The nonlinearity approach appears very convenient to display unexpected dynamics in cancer growth processes expressed in different reactions of the dynamics to different concentrations of immune cells at different stages of cancer growth developments. Taking into account all the complex processes, nonlinear mathematical models can be estimated capable of compensation and minimization the inconsistencies between different mathematical models related to cancer growth-anticancer factor affections. Of course, the development of powerful cancer immunotherapies requires an understanding of the mechanisms governing the dynamics of tumor growth.

Keywords: Cancer tumor model, Immune system, Mathematical modeling, Stability of dynamical systems, Equilibrium point, Multiphase attractors