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PROCEEDINGS BOOK

Edited by
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Gulnaz GAFUROVA

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THE GLOBAL DYNAMICS OF CONVENTIONAL CANCER TUMOR GROWTH MODEL

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Abstract

We present here, a phase-space analysis of a mathematical model of tumor growth with an immune responses. Consider mathematical analysis of the system of nonlocal equations regarding to dissipativity, boundedness of solutions, invariance of non-negativity, local and global stability and the basins of attractions.

In conventional models of population dynamics, consumption of resources by the individuals occurs at the same spatial location as reproduction and death. We assume in this work that the individual located at a point in the spatial domain can consume resources not only at that point but also at some neighboring region surrounding that point. Movement of the individuals to the nearby location occurs in a faster time scale compared to the movement from one location to the other one. This modifies the modeling approach and gives rise to a nonlocal differential equation with convolution terms describing the nonlocal consumption of resources. Such type reaction-diffusion equations with the nonlocal term is also used to explain the emergence and evolution of biological species and speciation were studied. We derive some features of behavior of the three-dimensional tumor growth models with nonlocal 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.

Keywords: Cancer tumor model, immune system, mathematical modeling, stability of dynamical systems, multiphase attractors