Travelling Wave Solution and Recurrent Algorithm for the Nonlinear Age-Structured Model of Polycyclic Population Dynamics

Vitalii Akimenko[1], Roumen Anguelov[2]
[1]Taras Shevchenko National University of Kyiv, Ukraine
vitaliiakm@gmail.com
[2] University of Pretoria, Republic of South Africa
roumen.anguelov@up.ac.za

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This work is devoted to the study of evolutionary dynamics of polycyclic age-structured one-sex population. It extends the work in [1], [2] for polycyclic population including the effect of nonlinear mortality (population growth feedback) and proliferation. Further, the population is assumed to have two types of individuals, proliferating and quiescent. The resulting mathematical model is based on the systems of initial-boundary value problems for the non-linear transport equation with integral boundary condition. This model describes both the temporal and age evolution of the density of the proliferating and quiescent subpopulations.

Using the method of characteristics and some modification of the steps method we derive a multistep recurrent algorithm which produces explicit travelling wave solutions. The compatibility conditions impose the restrictions on the model parameters and guarantee continuity and continuously differentiable of obtained solution. The explicit form of this solution is used to create the accurate recurrent numerical algorithm and carry out the series of numerical experiments with a set of parameterized algebraic functions. We study the asymptotical behavior of numerical solutions for the periodically oscillating functions of model parameters and obtained the quasi-periodical regimes of population dynamics in the form of harmonic oscillations and pulse sequence in the series of experiments.

References

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