Limit Cycles in a Mathematical Model of Three Interacting Species

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The paper presents a mathematical model for describing the dynamics of populations of three interacting species, predator and its two preys in the form of the system of differential equations

$$\begin{cases} \dot{x} = x \cdot (a - b_2 \cdot z), \\ \dot{y} = y \cdot (c - d_2 \cdot z), \\ \dot{z} = z \cdot (-e + h_1 \cdot x + g_1 \cdot y), \end{cases} \in G^+ \qquad \begin{cases} \dot{x} = x \cdot (a - b_1 \cdot z), \\ \dot{y} = y \cdot (c - d_1 \cdot z), \\ \dot{z} = z \cdot (-e + h_2 \cdot x + g_2 \cdot y), \end{cases} \in G^-$$

where the right-hand side has a discontinuity on the surface S. A package of symbolic-numerical software in Maple invironment is developed for integrating the system and presenting its solutions graphically, trajectories for certain parameter values are made up. It is shown that in such a model the presence of predator is enough (even with the lack of competition) to stabilize the populations of preys without causing either of them to completely extinct.

References

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