29th Annual Meeting of Differential Equations
Department of Applied Mathematics, National Chung Hsing University
Jan. 15-16, 2021

Structures and evolution of bifurcation diagrams for a one-dimensional diffusive generalized logistic problem with constant yield harvesting

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Abstract

We study the one-dimensional diffusive generalized logistic problem with constant yield harvesting:

$$\begin{cases} u''(x) + \lambda g(u) - \mu = 0, & -1 < x < 1, \\ u(-1) = u(1) = 0, \end{cases}$$

where $\lambda, \mu > 0$. We assume that nonlinearity g satisfies $g(0) = g(1) = 0$, $g(u) > 0$ on $(0, 1)$, and g either is concave on $(0, 1)$ or (is concave-convex on $(0, 1)$ and satisfies a certain condition). We prove that, for any fixed $\mu > 0$, on the $(\lambda, \|u\|_\infty)$-plane, the bifurcation diagram consists of a $\subset$-shaped curve and then we study the structures and evolution of bifurcation diagrams for varying $\mu > 0$. We also prove that, for any fixed $\lambda > \frac{\pi^2}{4g'(0)}$, on the $(\mu, \|u\|_\infty)$-plane, the bifurcation diagram consists of a reversed $\subset$-shaped curve and then we study the structures and evolution of bifurcation diagrams for varying $\lambda > \frac{\pi^2}{4g'(0)}$. It is a joint work with Kuo-Chih Hung and Yiu-Nam Suen.

2000 *Mathematical subject classification*: 34B18, 74G35