Bifurcation Curve for Semipositone Problem with Minkowski-Curvature Operator

Authors : Shao-Yuan Huang

Abstract : We study the shape of the bifurcation curve of positive solutions for the semipositone problem with the Minkowski-curvature operator. The Minkowski-curvature problem plays an important role in certain fundamental issues in differential geometry and in the special theory of relativity. In addition, it is well known that studying the multiplicity of positive solutions is equivalent to studying the shape of the bifurcation curve. By the shape of the bifurcation curve, we can understand the change in the multiplicity of positive solutions with varying parameters. In this paper, our main technique is a time-map method used in Corsato's PhD Thesis. By this method, studying the shape of the bifurcation curve is equivalent to studying the shape of a certain function T with improper integral. Generally speaking, it is difficult to study the shape of T. So, in this paper, we consider two cases that the nonlinearity is convex or concave. Thus we obtain the following results: (i) If $f''(u) < 0$ for $u > 0$, then the bifurcation curve is C-shaped. (ii) If $f''(u) > 0$ for $u > 0$, then there exists $\eta > \beta$ such that the bifurcation curve does not exist for $0 < L \leq \eta$ and is C- like shaped for $L > \eta$. Furthermore, we prove that the bifurcation is C-shaped for $L > \eta$ under a certain condition.

Keywords : bifurcation curve, Minkowski-curvature problem, positive solution, time-map method

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