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RADIAL NONNEGATIVE SOLUTIONS FOR A CLASS OF NONPOSITONE PROBLEMS IN A BALL

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Abstract

In this paper, we study the existence of positive radial solutions for a nonpositone semilinear elliptic boundary value problem of the form $-\Delta u=\lambda f(u)$ in Ω, $u=0$ on $\partial\Omega$, where Ω denotes the unit ball in $\mathbb{R}^n$ ($n\geq 2$) and $\lambda > 0$ is a real parameter. The nonlinearity satisfies the nonpositone condition $f(0)<0$, which creates substantial analytical difficulties since the classical maximum principle cannot be directly applied near the origin.

Assuming that f has exactly three positive zeros, is convex after its largest zero, and satisfies appropriate superlinearity and growth conditions, we investigate the structure of radial solutions. By exploiting radial symmetry, the elliptic problem is reduced to an ordinary differential equation. The shooting method is then applied to prove the existence of positive radial solutions. Furthermore, we analyze the qualitative behavior of the associated initial value problem.

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