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Time maps and exact multiplicity results for one-dimensional prescribed mean curvature equations

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1. Introduction

Consider the following quasilinear boundary value problem

$$\begin{cases} -\left(\frac{u'}{\sqrt{1+(u')^2}}\right)' = \lambda f(u), \quad x \in (-L, L), \\ u(-L) = u(L) = 0, \end{cases}$$
(1.1)

where λ and *L* are positive parameters. In this paper, we are concerned with exact numbers of positive solutions and signchanging solutions of (1.1) when λ and *L* change.

The corresponding semilinear problem

$$\begin{cases} -u'' = \lambda f(u), & x \in (-L, L), \\ u(-L) = u(L) = 0, \end{cases}$$
(1.2)

has been extensively studied. Many existence and multiplicity results have been obtained. For instance, see [1–6], and the references therein.

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ABSTRACT

We investigate various properties of time maps for one-dimensional prescribed mean curvature equations. Using these properties, we obtain some exact multiplicity results of positive solutions and sign-changing solutions. As it turned out, these quasilinear problems show many different phenomena from semilinear problems. Our methods are based on a detailed analysis of time maps.

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