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ON POSITIVE SOLUTIONS OF NONLINEAR TELEGRAPH SEMIPOSITONE SYSTEM

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Abstract. In this paper, we shall deal with the superlinear semipositone problem of a nonlinear telegraph system and establish the existence of positive doubly periodic solutions for the system. The proofs are based on a fixed-point theorem in cones.

Keywords. Telegraph system, semipositone problem, doubly periodic solution, cone, fixed point theorem.

AMS (MOS) subject classification: 35B15, 47H10.

1 Introduction

In this paper we are concerned with the existence of positive doubly periodic solutions for the nonlinear telegraph system

$$\begin{cases} u_{tt} - u_{xx} + c_1 u_t + a_1(t,x)u = b_1(t,x)f(t,x,u,v), \\ v_{tt} - v_{xx} + c_2 v_t + a_2(t,x)v = b_2(t,x)g(t,x,u,v), \end{cases} \tag{1}$$

with doubly periodic boundary conditions

$$\begin{aligned} u(t+2\pi,x) = u(t,x+2\pi) = u(t,x), \quad (t,x) \in R^2, \\ v(t+2\pi,x) = v(t,x+2\pi) = v(t,x), \quad (t,x) \in R^2. \end{aligned} \tag{2}$$

where $c_1, c_2 > 0$ are constants, $a_i(t,x), b_i(t,x) \in C(R^2, R^+)$, $f(t,x,u,v)$, $g(t,x,u,v) \in C(R^2 \times R^+ \times R^+, R)$ and $a_i(t,x), b_i(t,x), f(t,x,u,v), g(t,x,u,v)$ are 2π-periodic in t and x.

The existence of doubly periodic solutions for a single telegraph equation is studied by many authors when the nonlinear is bounded or linear growth, see [1]-[6]. The first maximum principle for linear telegraph equations was built by Ortega and Robles-Perez in [5]. They proved the maximum principle for the doubly 2π-periodic solutions of the linear telegraph equation

$$u_{tt} - u_{xx} + cu_t + \lambda u = h(t,x), \quad (t,x) \in R^2,$$