Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **10 (2003)** 579-591

EXISTENCE OF QUASIPERIODIC SOLUTIONS AND BOUNDEDNESS PROBLEM FOR THE ONE-DIMENSIONAL P-LAPLACIAN EQUATIONS

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Abstract. In this paper, we consider one-dimensional p-Laplacian equations of the form

$$(\phi_p(x'))' + \phi_p(x)^{2n+1} + \sum_{j=1}^{2n} q_j(t)\phi_p^j(x) = 0,$$

with q_j periodically depending on t. We prove the existence of infinitely many quasiperiodic solutions and the boundedness of all solutions for such equations via the KAM theorem.
Keywords. p-Laplacian, Littlewood's boundedness problem, invariant tori, quasiperiodic solutions.
AMS (MOS) subject classification: 35J05.

1 Introduction and Results

Recently many authors have studied the one-dimensional p-Laplacian equation of the following form

$$(\phi_p(x'))' + f(x,t) = 0, \tag{1.1}$$

where $\phi_p : R \to R$, given by $\phi_p(x) = |x|^{p-2}x$, is called p-Laplacian operator, and $p > 1$ is any real number. Various separated two-point boundary value problems containing this p-Laplacian operator have received a lot of attention with respect to existence and multiplicity of solutions. See [3, 6, 13, 18] and the references therein. Periodic boundary value conditions also have been considered in [4, 17](see, [5, 12]). The main approach used in these papers are topological degree theory and variational method [4, 5, 12, 13], fixed-point index theory [3,6], comparison theorems, Poincare-Birkhoff theorem, phase-plane analysis [4, 17, 18], and so on.

In this paper we discuss a problem of describing the behavior of solutions of (1.1) with

$$f(x,t) = \phi_p(x)^{2n+1} + \sum_{j=0}^{2n} q_j(t)\phi_p^j(x), x \in R,$$