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LIMIT CYCLES OF THE CLASSICAL LIÉNARD DIFFERENTIAL SYSTEMS: A SURVEY ON THE LINS NETO, DE MELO AND PUGH'S CONJECTURE

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ABSTRACT. In 1977 Lins Neto, de Melo and Pugh [Lectures Notes in Math. **597**, 335–357] conjectured that the classical Liénard system

$$\dot{x} = y - F(x), \quad \dot{y} = -x,$$

with $F(x)$ a real polynomial of degree n , has at most $[(n-1)/2]$ limit cycles, where $[\cdot]$ denotes the integer part function. In this paper we summarize what is known and what is still open on this conjecture. For the known results on this conjecture we present a complete proof.

1. INTRODUCTION AND STATEMENT OF THE MAIN RESULTS

The classical Liénard system

$$(1) \quad \dot{x} = y - F(x), \quad \dot{y} = -x,$$

with $F(x)$ a real polynomial of degree n , has been extensively studied (see for instance [2, 11, 20, 25, 31, 32, 39, 42, 43], and references therein). In 1977 Lins Neto, de Melo and Pugh [25] proved that there exist systems (1) of degree n having $[(n-1)/2]$ limit cycles, and stated the following:

Conjecture *System (1) has at most $[(n-1)/2]$ limit cycles, where n is the degree of the real polynomial $F(x)$.*

Here $[x]$ denotes the integer part function of x .

In this paper we summarize what is known and what is still open on this conjecture. Moreover for the known results on this conjecture we present a complete proof.

The conjecture was based in the following result of Lins Neto, de Melo and Pugh [25]:

Theorem 1. *If the real polynomial $F(x)$ has degree n , then there are Liénard differential systems (1) having at least $[(n-1)/2]$ limit cycles.*

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Key words and phrases. Liénard system, limit cycle, conjecture of Lins Neto, de Melo and Pugh.

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