Poincare Journal of Analysis & Applications
Vol. 10, No. 1 (2023), 23-27

DOI: 10.46753/pjaa.2023.v010i01.002

RATIONAL LIMIT CYCLES FOR A CLASS OF GENERALIZED ABEL'S POLYNOMIAL DIFFERENTIAL EQUATIONS

A. KINA† AND A. BENDJEDDOU

Date of Receiving : 11. 08. 2021
Date of Revision : 05. 11. 2022
Date of Acceptance : 13. 11. 2022

Abstract. In this manuscript, we deal with a class of generalized Abel's ordinary polynomial differential equations of the form

$$\frac{dy}{dt} = F(t)y^2 + G(t)y^n,$$

where $F(t)$, $G(t)$ are real polynomials with $G(t) \neq 0$ and $n \geqslant 3$. We prove that these Able differential equations have non-trivial rational limit cycles. We also discuss the relation between the existence of the non-trivial rational limit cycles and the degrees of real polynomials $F(t)$, $G(t)$.

1. Introduction and presentation of the main results

In this research, we want to study the existence of non-trivial rational limit cycles of a class of polynomial differential equations

$$\frac{dy}{dt} = F(t)y^2 + G(t)y^n, \tag{1.1}$$

where t, y are real variables and $G(t)$ and $F(t)$ are two real polynomials of degree r, s respectively with $G(t) \neq 0$.

The study of limit cycles of differential equations is one of the main problems in the qualitative theory of differential equations (see for instance [2, 10, 11, 12, 13]) in addition to that, the differential equations (1.1) are interesting because they happen in a lot of models of real phenomena (see for instance [3, 6]).

A periodic solution of equation (1.1) is a solution $y(t)$ defined in $[0, 1]$ such as $y(0) - y(1) = 0$, note that without loss of over-simplification we are supposing that

2010 *Mathematics Subject Classification.* 34C05, 34C07, 34C08.
Key words and phrases. Abel polynomial differential equations, periodic solutions, rational limit cycle.
Communicated by. Tayeb Salhi
† *Corresponding author*