Another exact solution to the van der Pol oscillator when the parameter is another function of time

Soumadeep Ghosh

Kolkata, India

Abstract

In this paper, I describe another exact solution to the van der Pol oscillator when the parameter μ is another function of time t.
The paper ends with "The End"

Introduction

The van der Pol oscillator[1] is given by the second-order differential equation

$$\frac{\partial^2 x(t)}{\partial t^2} - \mu \left(1 - x(t)^2\right) \frac{\partial x(t)}{\partial t} + x(t) = 0$$

where μ is a parameter

According to [2], "there are no exact solutions of the van der Pol oscillator".

However, when μ is a function of time, the van der Pol oscillator **does** have an exact solution.

In a previous paper, I've described an exact solution to the van der Pol oscillator when μ is a function of time t.

In this paper, I describe another exact solution to the van der Pol oscillator when μ is another function of time t.

Another exact solution to the van der Pol oscillator when the parameter μ is another function of time t

When $\omega \left(A^2 \sin^2(\omega t + \phi) - 1\right) \neq 0$ and

$$\mu(t) = \frac{\left(\omega^2 - 1\right) \tan(\omega t + \phi)}{\omega \left(A^2 \sin^2(\omega t + \phi) - 1\right)}$$

is defined, then $x(t) = A \sin(\omega t + \phi)$ is another exact solution to the van der Pol oscillator.

References

1. https://en.wikipedia.org/wiki/Van_der_Pol_oscillator
2. https://onlinelibrary.wiley.com/doi/10.1002/zamm.200310040

The End