





Journal of Nonlinear Mathematical Physics, Vol. 19, No. 4 (2012) 1250029 (12 pages) © J. Llibre and C. Valls DOI: 10.1142/S1402925112500295

## ON THE INTEGRABILITY OF A MUTHUSWAMY-CHUA SYSTEM

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> Received 18 April 2012 Accepted 28 June 2012 Published 31 December 2012

In this paper we study the integrability of the Muthuswamy–Chua system

 $x' = y, \quad y' = -\frac{x}{3} + \frac{y}{2} - \frac{yz^2}{2}, \quad z' = y - \alpha z - yz.$ 

For  $\alpha = 0$  we characterize all its generalized rational first integrals, which contains the Darboux type first integrals. For  $\alpha \neq 0$  we show that the system has no Darboux type first integrals.

*Keywords*: Darboux integrability; exponential factor; Darboux polynomials; Chua system; generalized rational first integrals.

Mathematics Subject Classification 1991: 34C05, 34A34

## 1. Introduction

Muthuswamy and Chua in [9] proposed the simplest electronic circuit producing chaotic attractors. This circuit contains a linear passive inductor, a linear passive capacitor and a nonlinear active memristor, and it can be described by the differential system

$$\begin{cases} x' = y, \\ y' = -\frac{x}{3} + \frac{y}{2} - \frac{yz^2}{2}, \\ z' = y - \alpha z - yz, \end{cases}$$
(1)

for any value of  $\alpha \in \mathbb{R}$ , where the prime denotes derivative with respect to the variable t. Here, as in [6], this differential system is written in a slightly modified form because the third equation is not  $z' = -y - \alpha z + yz$  as in [9] but rather  $z' = y - \alpha z - yz$ . The nonlinearity