Rendiconti del Circolo Matematico di Palermo Series 2
https://doi.org/10.1007/s12215-020-00507-4

Darboux integrability and dynamics of the Basener–Ross population model

Faruk Güngör[1] · **Jaume Llibre**[2] · **Chara Pantazi**[3]

Received: 15 January 2020 / Accepted: 8 April 2020

Abstract
We deal with the Basener and Ross model for the evolution of human population in Easter island. We study the Darboux integrability of this model and characterize all its global dynamics in the Poincaré disc, obtaining 15 different topological phase portraits.

Keywords Basener–Ross population model · Quadratic system · Poincaré disc · Darboux integrability · Darboux invariant

Mathematics Subject Classification Primary 34C05 · 34C23

1 Introduction and statement of the main results

In order to explore the evolution of ecosystems an isolated island is a good laboratory due to the total absence of external distortion factors like migration. Basener and Ross, see equation (5) in [3], proposed the following model for the evolution of human population in Easter island

$$\dot{x} = x(1-y), \quad \dot{y} = (h-1)y^2 + (1-c)y + \frac{c}{k}x, \tag{1}$$

✉ Faruk Güngör
gungorf@itu.edu.tr

Jaume Llibre
jllibre@mat.uab.cat

Chara Pantazi
chara.pantazi@upc.edu

[1] Department of Mathematics, Faculty of Science and Letters, Istanbul Technical University, 34469 Istanbul, Turkey

[2] Departament de Matemàtiques, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Catalonia, Spain

[3] Departament de Matemàtica Aplicada I, Universitat Politècnica de Catalunya, (EPSEB), Av. Doctor Marañón, 44-50, 08028 Barcelona, Spain