

COMPLEX DYNAMICS FOR UNBALANCED GENERALIZED DELTA-MODULATED DISCRETE-TIME CONTROL SYSTEMS

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Abstract. This paper investigates dynamic properties of Unbalanced Generalized Delta-modulated Discrete-time Control Systems for parameters $a > 1$ and $b > 1$. Dynamic of system belongs to one of following cases: 1. The set formed by all periodic orbits is dense and movement orbit either is dense or move into some a periodic orbit after finite mappings. 2. All periodic orbits form the union set of both finite dense subsets and finite nowhere dense sets. Movement orbit either will finally move into either the finite dense subsets or one of finite nowhere dense subsets or will move into the union above after finite mappings. 3. The set formed by all periodic orbits is the union of countable nowhere dense subsets. Movement orbit either is repelled into one of countable nowhere dense subsets or will move into the union above after finite mappings. 4. All periodic orbit is a nowhere dense set.

Keywords. Unbalanced Δ -modulated feedback, Periodic orbit, nowhere dense set, dense set, Movement orbit.

1 Introduction

As it is known, even a one-dimension nonlinear system may brings very complicated dynamics [2, 3, 6, 9].

In this paper, the following discrete nonlinear control system is considered:

$$x_{n+1} = f_a^b(x_n) + u = \begin{cases} ax_n & , x_n \geq 0 \\ bx_n & , x_n < 0 \end{cases} + u \quad (1)$$

under the so-called Unbalanced Δ -Modulated Feedback [UDMF]

$$u = \Delta(x_n) = \begin{cases} -a\Delta_1 & , x_n \geq 0 \\ b\Delta_2 & , x_n < 0 \end{cases} ,$$

where Δ_1, Δ_2 are given positive real numbers, and $\Delta_1 \neq \Delta_2$.