FRACTAL GEOMETRY IN MECHATRONICS

Jiří Hnízdil, Jan Novotný*

This article deals with reconstructing chaotic attractor through Freescale digital signal processor 56800 family. The system is designed to be used in the mechatronics applications for simulating dynamic's states of prothetic's knuckle. This conception fully supplants chaotic analog circuits.

1. Introduction

Every system in the nature has an attractor. An attractor is a steady state of any state variables in the space. It can for example be steady velocity of motor shaft, steady trajectory of the Moon around the Earth and so on. We distinguish the following types of attractors :
– Attractor is a fixed point
– Attractor is a periodic point
– Attractor is a kvaziperiodic point
– Chaotic attractor
– Strange attractor

Visualization of attractors creates different diagrams – for example visualization of chaotic attractor gives pictures called fractals. Fractals can be used in computer graphics as textures, in the nature – for example structure of fern leaf. We implement fractal geometry into digital signal processor.

Further information about attractors can be found in books which are listed in references chapter in the end of this paper.

2. Main part

Chaotic system can be represented by two different electrical circuits :

2.1. Circuits with analog devices

In this case, the circuit is composed of analog operation amplifier with nonlinear components in the feed forward loop. Classic schematic circuit which represents chaotic behavior is shown bellow in figure 1.

An epitome of analog chaotic integrated device can for example be Yamakawa's Lab & FLSI Chaos chip.

---

* J. Hnízdil, J. Novotný, Dept. of Power Electrical And Electronic Engineering, FEEC, BUT