3D Random Walk

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1 Introduction

1.1 Random Number Generator

The random number generator implemented here is a simple Linear Congruential Generator(LCG), which is generally a recursive mapping within a certain integer domain. for a set of parameters (a,c,m):

$$x_{N+1} = (x_N * a + c) \mod m$$
$$\xi\colon \{1, 2, 3, \ldots, m-1\} \to \{1, 2, 3, \ldots, m-1\}$$

Some special sets of (a,c,m) give seemingly very random and uniform distribution of results in recursive mapping. Based on this feature, we consider this recursive method as a random number generator.

In this experiment (a=1559, c=647, m=13229) are chosen. The main characteristic of these parameters is that they are all primes, in order to try to avoid periodicity behaviors in the random sequance. This special set is chosen by testing different combinations of (a,c,m) in a small parameter space.

1.2 Random Walk

A random walk, in simple terms, is a random sequance representing the accumulative sum of a random variable. In a simple 3D case:

$$\vec{X_n} = \sum_{i=1}^{n} \vec{s_i}$$
$$\text{where} \quad \vec{s} \in V = \{(1,0,0), (-1,0,0), (0,1,0), (0,-1,0), (0,0,1), (0,0,-1)\}$$
$$\text{Assigning} \quad P(\vec{v}) \equiv 1/6 \quad \text{for} \quad \vec{v} \quad \text{in} \quad V$$

2 Code

2.1 Linear Congruential Generator

2.2 3D Random Walk

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