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CHAOS IN PHYSICS: PART THREE PROPERTIES OF LORENZ SYSTEM UNDER RANDOM EFFECTS

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ABSTRACT: In this paper we investigate the effect of random dynamics on the Lorenz (fluid & laser) attractors. A snapshot attractor is generated by the choice of a cloud of initial conditions, each iterated alone then all viewed at a single instant (i.e. iteration). A variable of uniform probability distribution in the interval [-1, 1] is added to Lorenz system which shows some modifications (effects) on the Lorenz attractors.

1. INTRODUCTION

The problem of the effect of random (or noisy) dynamics on attractors can be addressed in two different ways [1]:

1. By considering a cloud of inital conditions and evolve it forward in time under a given realization of the noisy dynamics. Then view the resulting measure at a single instant of time [1].
2. By looking at the evolution of a single initial condition under a realization of the random dynamics, and plot its position in phase space of times.

In this article we apply these ideas to the well known Lorenz system [2], or Lorenz attractor. LS is one of the simplest system used to describe turbulence in fluids dynamics especially how a preheated state of a system characterized with total obvious disorder changes abruptly when it is far from thermal equilibrium. At the same time LS can be used to study the undamped spikings seen in single mode "bad cavity" lasers as a result of the similarities between fluids and lasers since both can be described by the Ginzburg-Landau equations [3].

In fluids, there exists three different parameters in LS, viz, the prandtl number σ, Pr which represents the ratio of Rayleigh number to the critical R. number and a constant b that have no effect on the state of the fluid [4].

In lasers there exists another parameters, viz, p, which represents the ratio between relaxation rates of electric field and polarization, R the pumping parameter of the laser medium and b ratio between relaxation rates of population inversion and polarization.