J. Math. Kyoto Univ. (JMKYAZ)
16-1 (1976) 209-222

Perturbation of random processes and ergodicity of some simple infinite system

By

Toshio NIWA

(Received April 26, 1975)

0. Introduction

In spite of their great interests in statistical mechanics, very little are knowh about the ergodic properties of infinite systems of particles except the system of hard rods moving in one-dimention [2]. Recently Hardy et al. [1] have studied some interesting two-dimensional system. As is simple its dynamics, it is possible to obtain some ergodic properties, however, only for "linearized" time evolution.

In this paper we propose some simple model systems which are generalizations of the system of Hardy et al. in part, but the domain where collisions do occur is bounded. These models can be seen, in some sense, as the finite systems surround by ideal gasses. We investigate some ergodic properties of these models. We show that these systems are Bernoulli systems (Theorem 1 of section 1), therefore, they have mixing properties, and that the time correlation functions are decreasing exponentially (Theorem 2 of section 1).

Unfortunately, our systems have no interactions between particles except those of which are in some bounded domain. So the systems are to be considered as "perturbed ideal gasses". However it seems to me that the dissipative character of the interactions together with the statistical nature of the systems, that is, the infinite many of degrees of freedom of the systems will play some important role for the ergodicity even for the unrestricted systems.