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*Design of "Random Walker" for Monte-Carlo method**
Part I (Theory)

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§1. Introduction

A model of "Random Walker", which is a sort of computor for such Monte Carlo methods as discussed in this paper, has been constructed in our institute. An outline of the mathematical principles on which it is based is given below.

Let Ω be a simply connected domain whose boundary Γ is of *arbitrary* shape. The following problems will be considered under this condition.

(I) Eigenvalue problem

$$\Delta\varphi+\lambda\varphi=0 \text{ (in } \Omega), \quad (\varphi)_\Gamma=0.$$

(II) Dirichlet problem

$$\Delta\varphi=0 \quad \text{(in } \Omega), \quad (\varphi)_\Gamma=f.$$

(III) Poisson's equation

$$\Delta\varphi=\rho \quad \text{(in } \Omega), \quad (\varphi)_\Gamma=f.$$

(IV) First-passage problems on random walk. The precise meaning of this term will be made clear later in this paper.

The computor has been designed to give the approximate characteristics to the solutions of the above problems. Of course, refinements of these results will be necessary if the exact solutions are desired.

In Part I, we will give the mathematical principles, upon which our Monte-Carlo methods are based, though the principle themselves are already known for the most part. In Part II (to be published in this journal by T. Mikami and H. Hirai) the mechanical devices required by these principles will be explained in detail. An outline of the procedure used is given below. In the 2-dimensional case, a square lattice is drawn on the surface of Braun tube. A light spot on one of the lattice points can then jump randomly to one of its four neighboring points by the instruction sent from a random number generator. A black mask, the shape of which is similar to the domain Ω is put on the surface of the tube. A light spot starting from a fixed lattice point walks randomly along the lattice lines, and after some steps appears at one of the boundary points and is thereupon detected

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