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A Brownian Ball Interacting with Infinitely Many Brownian Particles in R^d

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1. Introduction and main results.

In this paper we construct a system of a hard ball with radius $r(\in(0,\infty))$ interacting with infinitely many point particles in R^d $(d\geq 2)$. All particles and the ball are undergoing Brownian motions and when the distance between a particle and the center of the ball attains a given constant r, they repel each other instantly. Saisho and Tanaka [5] constructed a system of mutually reflecting finitely many hard balls by solving certain stochastic differential equation of Skorohod type. Following the idea of [5], Saisho [4] constructed a system of mutually repelling finitely many particles of m types: the number of particles of type k is n_k $(\sum_{k=1}^{m} n_k = n < \infty)$ and when the distance between two particles of different type attains a constant r, they repel each other instantly. In case each type consists of only one particle, the model of [4] is reduced to that of [5]. Our present model in this paper is formally regarded as the case of $m=2$, $n_1=1$ and $n_2=\infty$ in the model of [4].

Let $\mathfrak{M}_0$ be the set of all countable subsets η of $R^d \setminus U_r(0)$ satisfying $N_K(\eta)\equiv \sharp(\eta\cap K)<\infty$ for any compact subset K, where $U_r(x)=\{y\in R^d : |x-y|<r\}$. The configuration space of a hard ball with radius r and infinitely many point particles is defined by

$$X=\{x=(x_0, x_1, \cdots)\in(R^d)^\infty : \{x_i-x_0, i\in N\}\in\mathfrak{M}_0\},$$

where x_0 is the position of center of the hard ball and x_i is that of the i-th point particle. We put $W_0=C(w:[0,\infty)\to R^d, w(0)=0)$ and $W=W_0^\infty$. Given $x=(x_0, x_1, \cdots)\in X$ and $w=(w_0, w_1, \cdots)\in W$, we consider the following equation (1.1) under the conditions (1.2), (1.3) and (1.4):

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