Re: question about particle−wall collision simulation

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- *From*: "PD" <TheDraperFamily@xxxxxxxxx>

- *Date*: 18 Nov 2005 09:18:04 −0800

maarten wrote:
> Hi,
>
> I am programming a simulation (java) with particle−particle collisions and
> particle−wall collisions. All entities are 2D.
> The particles are modelled as hard spheres. Internal energy is not modelled.
> This work nice. You can see the particles moving with a brownian motion.
> The problem occurs when I want to model a correct particle wall collision:
> − what is the direction vector after the collision?
> − what is the energy (=temperature) of the particle after the collision?

A 2D model of a gas (which is what you have) simply has to require conservation of momentum (in both x and y directions) and conservation of kinetic energy in every collision.

The same thing is true for a wall.

What this will yield, for example, for a y−wall (parallel to y−axis) at x=L/2, is that
v_x(before) = −v_x(after)
v_y(before) = v_y(after)

This is for a case where the wall does not transact energy with the particle. This isn't perfect, even in the case where the gas is in thermal equilibrium with the wall, but it's close. If you want to add thermal transactions with the wall, then the easiest thing to do is to treat every wall collision like the collision with another particle having kinetic energy equal to the average kinetic energy of the particles in the gas.

PD

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> I tried the following:
> 1) The direction of the particle after the collision is completely random.
> The energy is such that the temperature is equal to the temperature of the
> wall.

> 2) The direction of the particle after the collsion is straight from the
> wall. The energy is such that the temperature is equal to the temperature
> of the wall.
> 3) The direction of the particle is such that alpha_in=alpha_out. The energy
> is such that the temperature is equal to the temperature of the wall.
>
> All seem to work OK, with the exception that the 2nd option requires enough
> particles for introducing enough chaos.
>
> Does sombody know whether it is good physics to simulate a particle−wall
> collision this way? Or a website where I can find theory about this topic?

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    - ◊ *From:* maarten

- ***References***:
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    - ◊ *From:* maarten

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