Attempt 2

This paper is supposed to be an outline for my second attempt at simulating a system with an arbitrary number of particles, (limited by the efficient computational abilities of the code and the Processor itself) with a randomized variable. For now, I am not trying to give the system an inherent broad periodic property, that will be pursued later. Below is the simple description of the system I'm hoping to simulate. This is not the final set-up, it is a start, subject to further improvements, feedback is encouraged. Note: For now, all quantities are dimensionless, unless specified otherwise

1. I will start by initializing a random array of n (user input) elements (decimals with a set precision) within a defined range. This list (referred to as X) of elements will represent the position of n particles within the defined range. The 'position' is represented by the variable x. For now, we are working with a 1-dimensional list.

2. Now I will define a Variable *V(x)* for each x in the list where, $V(x) = sinx$. Now I will store the n values of *V(x)* in a separate list. From now on, this list, referred to as *V*, will be used to interact with the system of particles signified by X. This is to stress the physical existence of the system being simulated, as in a real world scenario, we cannot best describe a many-particle system directly using their positions. Certain Quantities depending on the position, like in this case *V(x)*, help us understand the behaviour and dynamics of the system much better.

3. Now we will define the evolution of x in the list X by using the list V. For every x, I will define a variable y, where $y \in [V(x) - 2, V(x) + 2]$. This Range is Arbitrary and soon I would like the constants (2 in this case) to be dependent on *V(x)* as well. Now I define the evolution of

x as, $x_j = x_{j-1} + y$ where j is the iteration. This ensures a simple evolution of the particles in list X as defined by the Quantity *V(x)* in the list *V*.

4. I would now like to define the random external perturbation, i. Every iteration, there is a known probability that a chosen 'particle' will experience a perturbation, the *ifactor*, a decimal with some set precision. Again, this change will first be applied to the list *V*. An analogy would be describing individual particles in a box containing an Ideal Gas Molecules, being heated Locally. We use the Change in Temperature to describe the change in Kinetic Energy, which can in turn be used to describe individual particles. In our system, I will randomly choose an element $V(x_a)$ from the list V and apply the *ifactor* on that element. The rest of the elements in list V will change depending on the position from the element at index a, according to a particular rule. An example being, the *ifactor* decreases by half when it moves away from the element at index a by 1 index value.

5. Now, at the start of the simulation, we'll have a list of particle positions x which change according to the Quantity *V(x)*, which itself depends on x; $V(x) = sinx$. As x is directly dependent on *V(x)*, the *ifactor* affects x. And as *V(x)* depends on x, any change is carried forward through iterations. Now that we've set up a system of particles with inter-related properties and a random variable, we can now start plotting some Quantity.

6. I wanted to plot a Quantity which would give us a good idea of the state of the system at the end of any iteration, similar to state variables like Temperature and Pressure in a Thermodynamic system. For now, I have settled on the difference $V_d = V_l - V_s$, where V_l and V_s are the largest and the smallest Values in the list V in any given iteration. This is mostly because the Quantity *V(x)* is the Quantity we interact with, so it would make sense to plot it. The other reason being that I feel that V_d would give us a fair idea of the 'range' of the system. We could plot a similar range directly for x, but there is no information given by x which cannot be obtained using *V(x)*.

This is the basic setup of my simulation. I have doubts about the quantity V_d I'm plotting since I cannot come up with a concrete explanation of why its a good Quantity. Any Feedback is encouraged.