EXERCISES 2a,a AND 3

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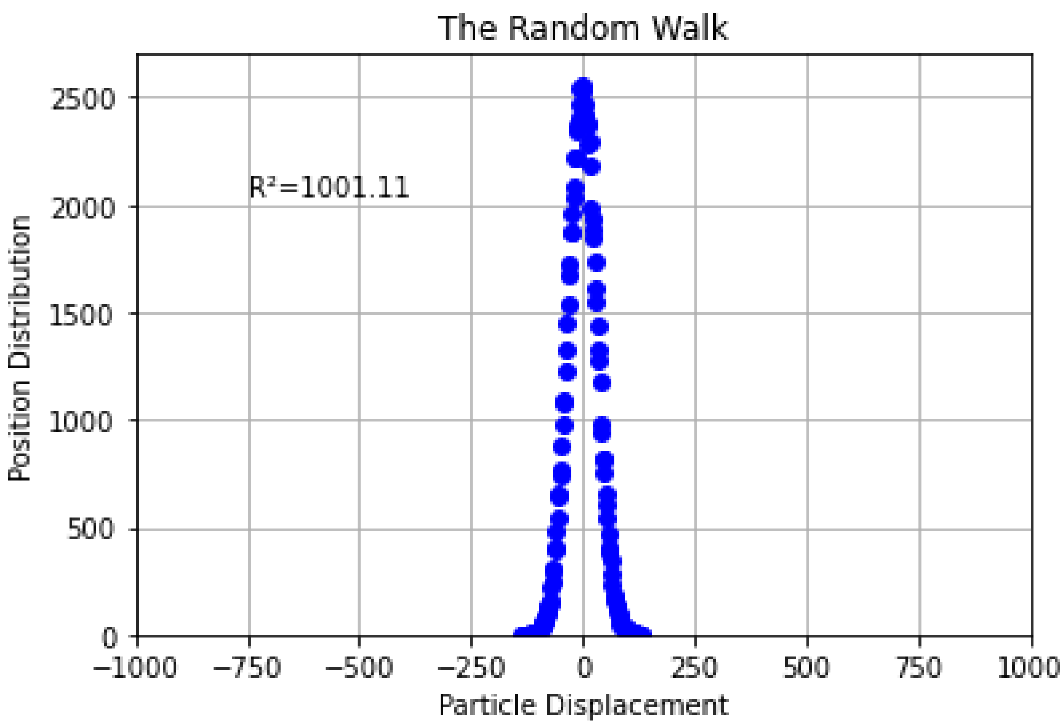
Preparation for thesis

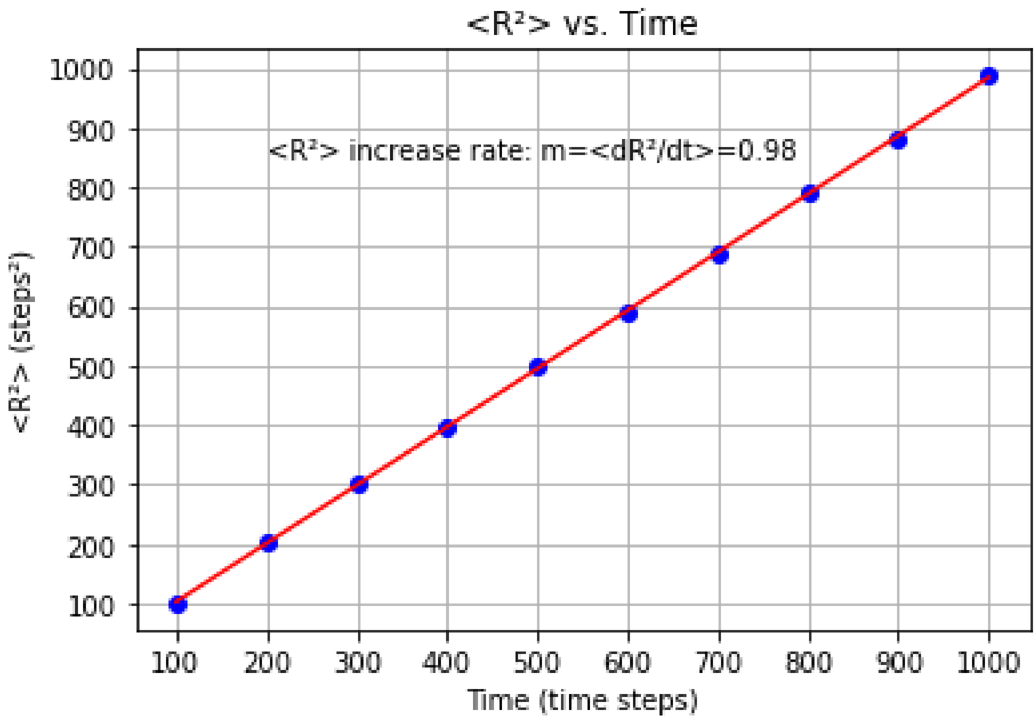
2. Create a program which performs a random walk for $N = 1000$ steps. You will do that for two cases: **(a)** a one dimensional system, **(b)** a two dimensional system. The program should calculate the square displacement R^2. Run the program for 10000 runs and find the mean square displacement, namely $<R^2>$.

For the first part of the part of the exercise we create and ran our simulation for 10000 runs. The result is shown in the graph below:



3. Use the program in the previous exercise to find the same thing, i.e. $<R^2>$ but now every 100 steps, from 0 to 1000. You will perform 10000 runs and find 10 points (one every 100 steps), of which every point will be the average of 10000 runs. Plot your results, namely $<R^2>$ vs. time. Use the least squares method as a fitting method to find the best straight line and the slope. Describe your conclusions.

In this exercise we did the same thing as before, but now in every 100 steps of the 1000 total steps per 10000 runs of the program. We calculate 10 points (one every 100 steps) which every point is the average R^2 of the 10000 runs in the hundreds of steps that each point identifies. The result is shown in the graph below:



We can understand from the graph that our data have a very nice fitting with the Least Squares Linear Regression Line, as it shows us that the mean square displacement has a smooth increase over time. The slope of the Line determines the rate of this increase is about 1 $step^2$ every time step. As the time goes on, so does mean square displacement.