Discussion on Random Walk Problem

This problem involves studying the nature of a random walk by generating random angles. Such type of study is used to understand the behaviour of a walker who takes steps randomly in any direction. This can be useful in determining the final position, net displacement from initial position, average displacement along the coordinate axes, root mean square displacement of the walker after a finite number of random walks. In this problem, it is found that the radial distance covered remains near origin mostly (as obtained from the plot of 5 random walks).This may be due to back-tracing when $\boldsymbol{\pi \leq \theta \leq 2\pi}$**.** Besides, the average displacement along x-axis and y-axis is very much close to 0, which is very much expected due to movement along both negative and positive directions. Moreover, from the plot of R_{RMS} vs $\sqrt{N}$ (where N is total number of steps), it is observed that at large values of number of steps, a nearly straight line is obtained with slope close to 1. Hence, this random walk problem agrees with the law of large numbers, i.e for larger numbers $R_{RMS} \sim \sqrt{N}$. Finally, this random walk problem can serve as a perfect model to simulate various random walks.

Discussion on Volume of Ellipsoid

This problem involves studying the ellipsoid volume through Monte Carlo simulation of data. Here random numbers are generated for fixing the x, y and z parameters of ellipsoid using the lower and upper limits obtained from parameters a, b and c of ellipsoid. Such problems can be used to get a rough estimate of volume of various solids if their equation is known. This can also be used to predict the shape and volume of unknown solids by comparing them with the measurements done on known solids. Here, it is observed that the numerical or estimated value of volume of ellipsoid converges very much close to its analytical value for larger number of steps. Also, the fractional error ($\boldsymbol{\Delta V/V}$)$\rightarrow$0 for very large values of steps. Moreover, from the 3D plot of ellipsoid for moderately large number of data points, a graphical representation of the estimated volume can be illustrated. Therefore, for large number of data points, this Monte Carlo problem can be utilized as an ideal prototype to numerically predict the volume of various solids.