MATH96012 Project 1

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October 30, 2019

Part 2

For each simulation, we establish some variables:
N: number of particles
L: length of side of square domain
s0: speed of particles, s0 = 0.2
r0: particles within distance r0 of particle i influence direction of motion of particle i,r0 = 1
A: amplitude of noise
Nt: number of time steps

Under each figure I will note the specific variable values that generated the figure in question.

0.1 Findings

I began my analysis of how α is affected by changes in A by using small variable values given in the caption of fig21. As described in the project assignment, we can clearly see that there is an initial transient where α sharply increases for A $\leq$ 0.6. For A between 0.6 and 0.8, we see that α continuously fluctuates between 0.0 and 0.7.

For fig22, we keep all variables the same except for N, which we double to 32. α behaves in a very similar manner to fig21, however for A = 0.7,0.8, α fluctuates between 0.0 and 0.5.

For fig23, we focus in more detail on A between 0.64 and 0.80 to try to identify A*, where α varies most frequently as A is varied. The graph here is clearly quite compact and α fluctuates considerably for all values of A considered. To attempt to determine an estimate for A*, we set p1.py to output the variance of α for each value of A. On inspection of these results, we estimate $\alpha \approx 0.66$.

For part 2.2, we look at how α depends on 1 - A/A* for A less than (A* - 0.025).

A* $\approx$ 0.66, so we set A to vary between 0.2 and 0.4, increasing in increments of 0.04. We can see that α, after an initial transient where it rises rapidly, is relatively stable, for A = 0.32, 0.36, 0.40, whilst α has the largest variance when A = 0.24.

Figures

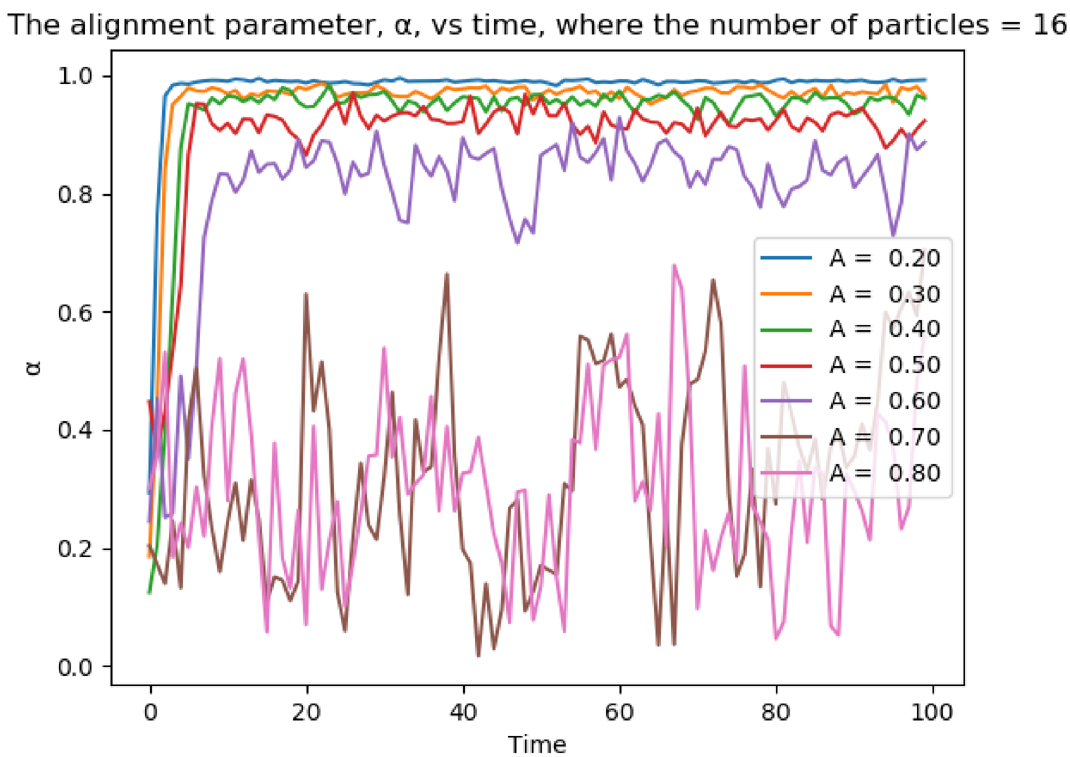

Figure 1: Nt=100,N=16,L=4,A in range(0.2,0.8)

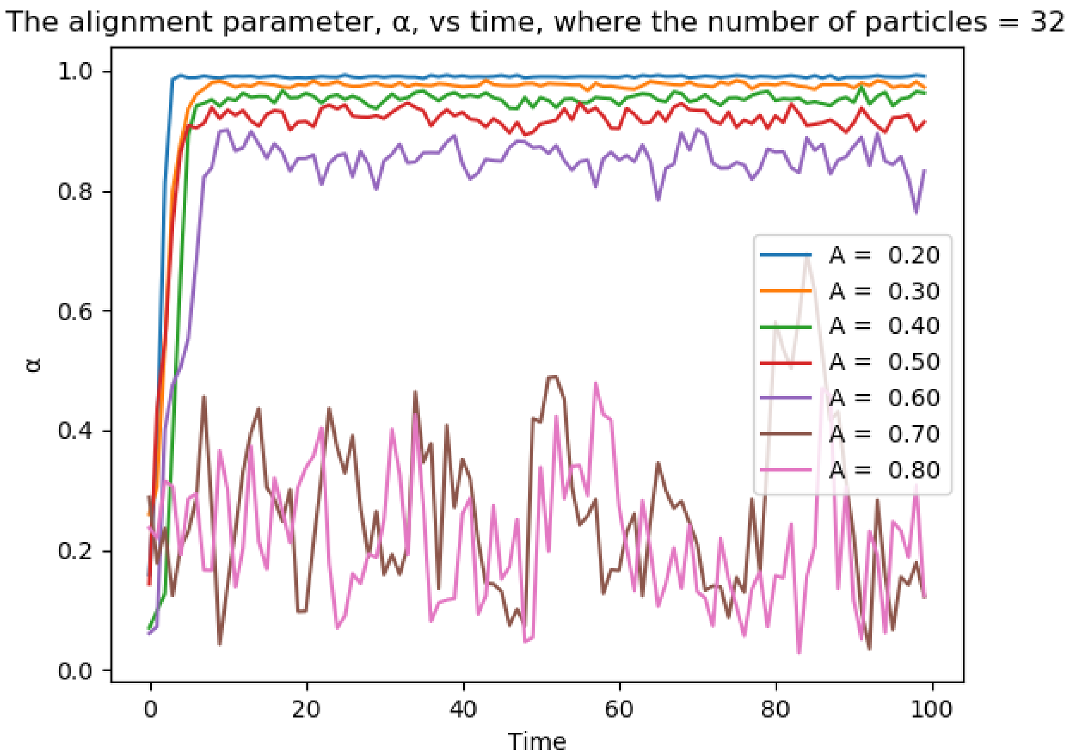

Figure 2: Nt=100,N=32,L=4,A in range(0.2,0.8)

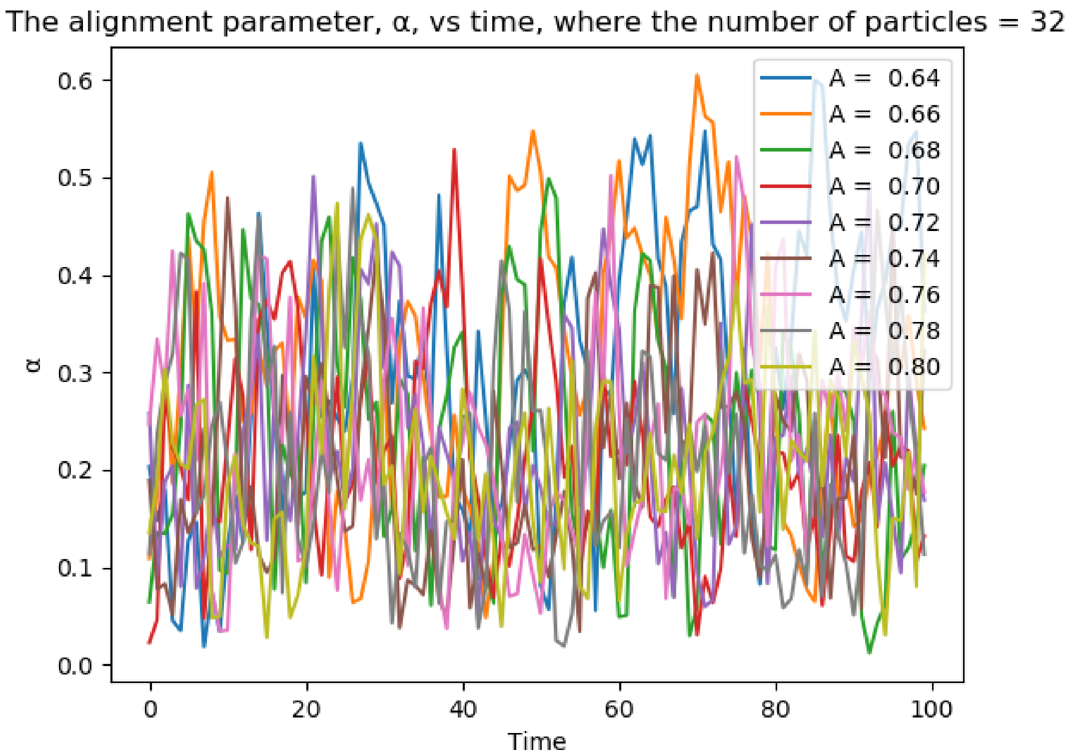

Figure 3: Nt=100,N=32,L=4,A in range(0.60,0.80)

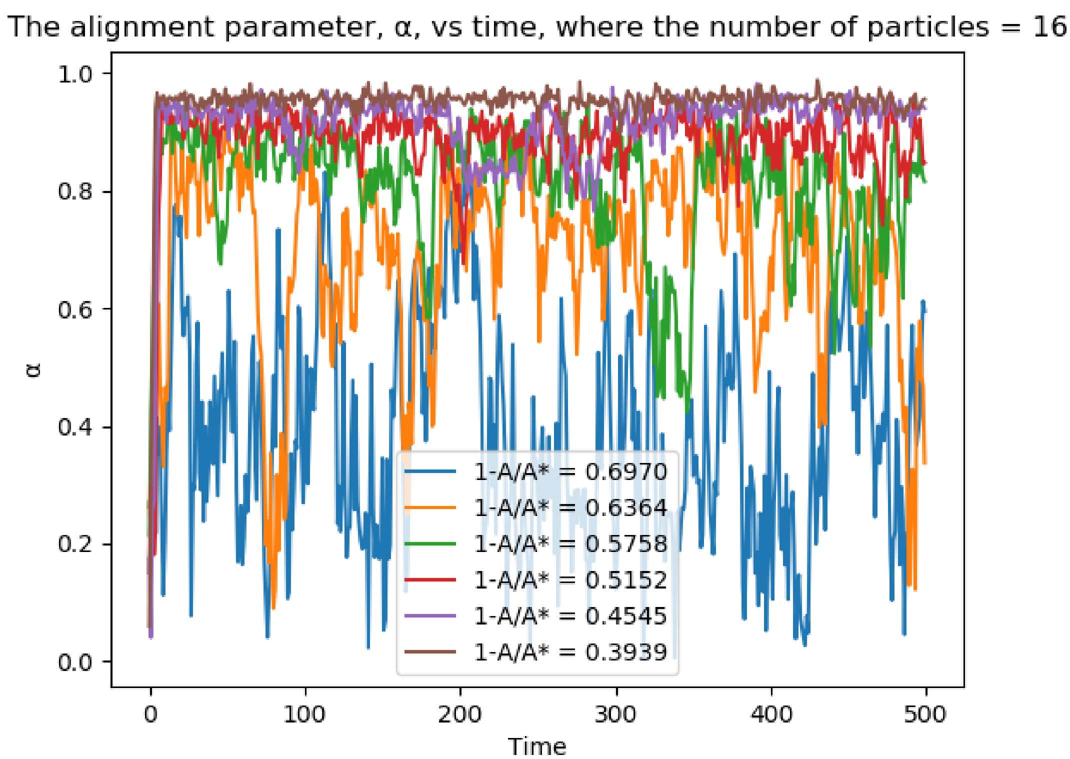

Figure 4: Nt=100, N=16, L = 4, 1 - A/A* in range(0.3939,0.6970)