UPPSALA UNIVERSITY
DEPARTMENT OF MATHEMATICS
Fiona Skerman

Assignment 6
Spring 2020

Lab 5: Self-propelled particle models.

The deadline for this sheet is midnight Sunday 24th of May.

Please submit hand-ins on Studentportalen. All code should be included. Please feel free to submit videos illustrating your results where appropriate, via Studentportalen or uploaded elsewhere. You may work in groups of size 1-4, and only one group member needs to submit the assignment. State clearly the members of the group. This exercise will be covered in lab session on Monday 11th of May.

6. Self propelled particles

This assignment investigates the Vicsek alignment model. As a starting point you may use `Align2D.m` or the python implementation provided on the course webpage. You may also write or find another implementation of the Vicsek alignment model with a fixed radius of alignment. Try running the model with different parameter values.

1. Implement the polarisation measure discussed in the lecture. For a fixed number of particles and fixed radius* investigate how the polarisation changes as a function of the noise parameter η (denoted e in the matlab implementation). In particular draw a phase transition plot of η versus polarisation.
   *(e.g. $N = 40$ and $L = 20$ in the matlab code, or $N = 40$ and $r = 0.5$ in the python implementation) **(5 points)**.

2. Implement an attraction rule in the model. Also, develop a measure of aggregation for the model. The aggregation measure should capture how close together group members are. You can implement the attraction rule and the aggregation measure in any way you like, as long as they make sense. Explain why you chose that form. Make a phase transition diagram of how the parameter values in your model affect your aggregation measure **(5 points)**