

# Bio-Inspired Artificial Intelligence - EMATM00029

## Exercises - Swarm Robotics

### TED talks

Watch the following video related to swarm robotics, reflect on the potential and limitations of the approaches described:

<https://youtu.be/LHgVR01zFJc?list=PLPwD130aGbndtCwvT1hUieedttfKEbMmX>

### Flocking

Download the following code: <https://github.com/mangecoeur/optboid>.

Run it using python:

```
python curseboid.py
```

Open the simulation.py file and look for "Boids class". Change the value of the parameters cohesion\_strength, align\_strength, and sep\_strength.

In a couple of words, describe how this changes the overall flocking behaviour. What happens when each parameter is set to 0?

### Particle Swarm Optimisation

Write down the rules for particle swarm optimisation (PSO) in common language.

Imagine you're trying to approximate  $x$  and  $y$  such that  $x^2 + y^2 = 0$ . Initialise three particles in  $[1,0]$ ,  $[0,1]$ ,  $[1,1]$ . The swarm neighbourhood is of radius 1. Perform 3 steps of the PSO algorithm for all the particles. Are you any closer to the solution in  $[0,0]$ ? Assume all updates are done in parallel.

### Swarm Engineering

Briefly describe two techniques to design a controller for a robot that will give you a desired swarm behaviour.

Imagine you are artificially evolving a swarm of robots, name one condition that improves the evolution of cooperative, rather than deceptive or individualistic behaviour?