# Assignment 4

Text

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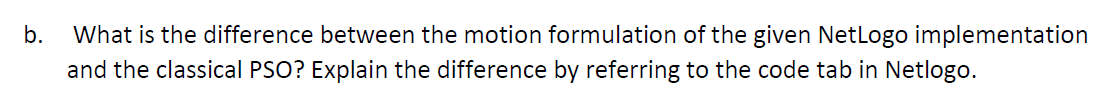
|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Impact** | |
| **No** | **Change** | **Speed of convergence** | **Ability to find global optima** |
| 1 | Effect of Increasing Population | Convergence is achieved faster when the population size is increased | More consistently finds the accurate values for the global maxima |
| 2 | Effect of Increasing the Speed Limit | Increasing the speed can decrease the speed of convergence because now the swarm is exploring a larger search space, leading to a slower convergence | Increasing the speed limit ca encourage more global exploration. In doing so, the particles have a greater likelihood of finding the global optima |
| 3 | Effect of Increasing the particle’s inertia | Increasing the particles’ inertia results in minimal local exploitation, and so, they might lead to a slower convergence | Increasing the particles’ inertia results in more exploration in the direction of search of the current solution which can increase the ability to find the global maxima |
| 4 | Effect of increasing the personal best factor | Since the personal best factor contains more information from past moves, they can faster convergence based on their own biases | Increasing the personal best factor means you are less susceptible to be trapped in a local minimum |
| 5 | Effect of increasing the global factor | Since the global factor contains more information from the general swarm, they can decrease convergence | Increasing the global factor can also result in larger diversity, and the PSO having a greater chance of finding the global optima |

<https://www.researchgate.net/publication/257743113_Fast_Convergence_Particle_Swarm_Optimization_for_Functions_Optimization> - 2

[https://iopscience.iop.org/article/10.1088/1757-899X/594/1/012011/pdf - 3](https://iopscience.iop.org/article/10.1088/1757-899X/594/1/012011/pdf%20-%203)

[https://web2.qatar.cmu.edu/~gdicaro/15382/additional/CompIntelligence-Engelbrecht-ch16.pdf - 4](https://web2.qatar.cmu.edu/~gdicaro/15382/additional/CompIntelligence-Engelbrecht-ch16.pdf%20-%204)

[**https://web2.qatar.cmu.edu/~gdicaro/15382/additional/CompIntelligence-Engelbrecht-ch16.pdf**](https://web2.qatar.cmu.edu/~gdicaro/15382/additional/CompIntelligence-Engelbrecht-ch16.pdf) **- 5**

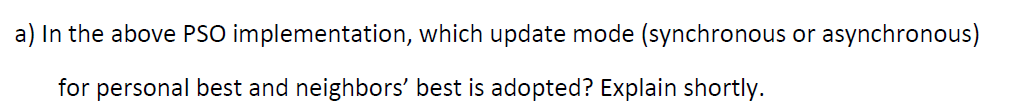


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This is an **asynchronous update mode**. This is because the neighborhood best update is in the particles loop, to be updated individually. We can see this in the outlined orange section above. In this case each particle’s individual solution state, whenever the neighbor is accessed, we change the best and adopt the neighbor.

Same with the personal best solution, we can see from the blue section that the individual performance is updated in every iteration for each particle.

Text

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If you want to change the algorithm to work on a synchronous mode, we need to move the code in the blue and orange blocks till after the “for all particles” loop, so we update the neighborhood and personal best once for each particle

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When C1 is set to 0, then the velocity model reduces to just the social component, and so all particles will be attracted to Nbest which is either the local or global best value. This can cause certain areas to be unexplored, and particles might end-up converge at a sub-optimal solution.

Logo

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When C2 is set to 0, then the velocity model reduces to just the cognitive component, and so all particles will be attracted to Pbest which is each particle relying solely on its previous best value obtained. This can cause each particle to act as independent hill-climbers and may not result in them converging to a solution.

Shape

Description automatically generated with low confidence

The W parameter is important because it is used to balance exploration and exploitation. Large values of W promote exploration, allowing more potential solutions to be explored, and more optimal solutions to be reached. Whereas smaller values of W promote more exploitation, allowing the algorithm to place more control on cognitive and social components, which can lead to converging at a potential solution.

Chart

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Graphical user interface, chart

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