1.) Initialize Population [Current Iteration (t) = 0]

Population Size = 4;

xi : (i = 1,2,3,4) and (t = 0)

$x1$ =1.3;

$x2$=4.3;

$x3$=0.4;

$x4$=−1.2

2.) Fitness Function used:

$$f(x) = \sum_{i=1}^{n} x_i^2$$

Compute Fitness Values for Each Particle using fitness function.

$f1$=1.69;

$f2$=18.49;

$f3$=0.16;

$f4$=1.44;

3.) Initialize Velocity for each particle in the current Population.

$v1$=0;

$v2$=0;

$v3$=0;

$v4$=0;

4.) Find Personal Best & Global Best (G_Best=0.4;) for each Particle.

G_Best=0.4;

- $P^1_{Best,1} = 1.3;$
- $P^1_{Best,2} = 4.3;$
- $P^1_{Best,3} = 0.4;$
- $P^1_{Best,4} = -1.2$

5.) Calculate Velocity for each Particle.

Calculate Velocity by:

$$v_i^{t+1} = wv_i^t + c_1 r_1 (P_{Best,i}^t - x_i^t) + c_2 r_2 (G_{Best}^t - x_i^t)$$

$v\_1^{(0+1)}=1*0 +1*0.233(1.3 -1.3)+1*0.801(0.4 -1.3)$;

$v\_1^1=0.7209$;

$v\_2^1=-3.1229$;

$v\_3^1=0$;

$v\_4^1=1.2816$;

6.) Calculate Position for each Particle.

Calculate Particles Position by :

$$x_i^{t+1} = x_i^t + v_i^t$$

$x\_1^{(0+1)}=1.3 +0.7209=2.0209$;

$x\_2^{(0+1)}=4.3 -3.1229=1.1771$;

$x\_3^{(0+1)}=0.4+0=0.4$;

$x\_4^{(0+1)}=-1.2+1.2816=0.0819$;

7.) Calculate Fitness Values for each Particle (t = 1).

$f\_1^1=4.084$;

$f\_2^1=1.3855$;

$f\_3^1=0.16$;

$f\_4^1=0.0067$;

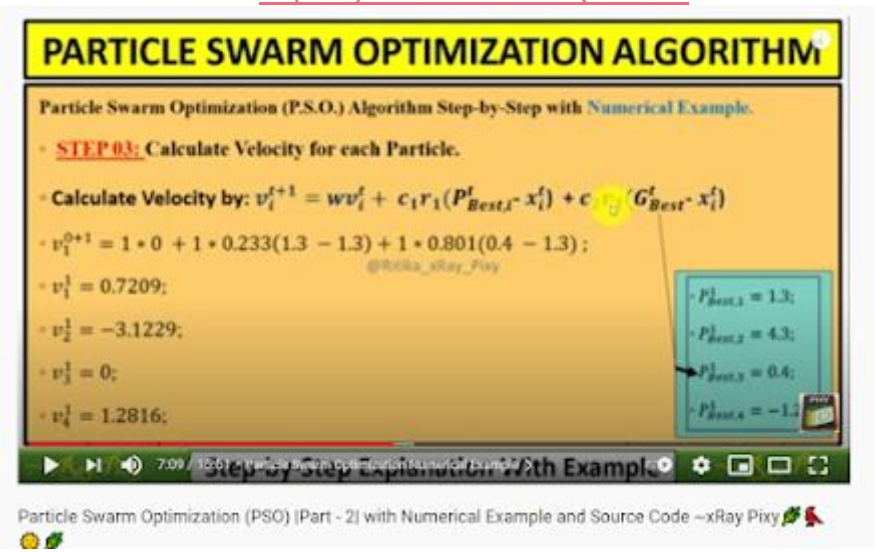
8.) Repeat Until Stopping Criteria is met.

```
Iteration 87: Best Cost = 0.20362
Iteration 88: Best Cost = 0.14245
Iteration 89: Best Cost = 0.14245
Iteration 90: Best Cost = 0.12074
Iteration 91: Best Cost = 0.10434
Iteration 92: Best Cost = 0.10298
Iteration 93: Best Cost = 0.084605
Iteration 94: Best Cost = 0.070687
Iteration 95: Best Cost = 0.063776
Iteration 96: Best Cost = 0.055252
Iteration 97: Best Cost = 0.055252
Iteration 98: Best Cost = 0.055252
Iteration 99: Best Cost = 0.035831
Iteration 100: Best Cost = 0.030934
```

(Output after 100 iterations)

For More details watch this video:

Link: https://youtu.be/Dds5CQGwxlM



Particle Swarm Optimization (PSO) [Part - 2] with Numerical Example and Source Code ~xRay Pixy