Implementing PSO using Lookup Table:-

$P_{mpp} = 180$ W

$V_{oc} = 43.64$

$I_{sc} = 5.45$

$V_{mp} = 36.36$

$I_{mp} = 4.95$

$D_{mpp} = 0.88$ (calculated from Lookup Table and assuming R_{load})

Step 1: lookup Table is generated
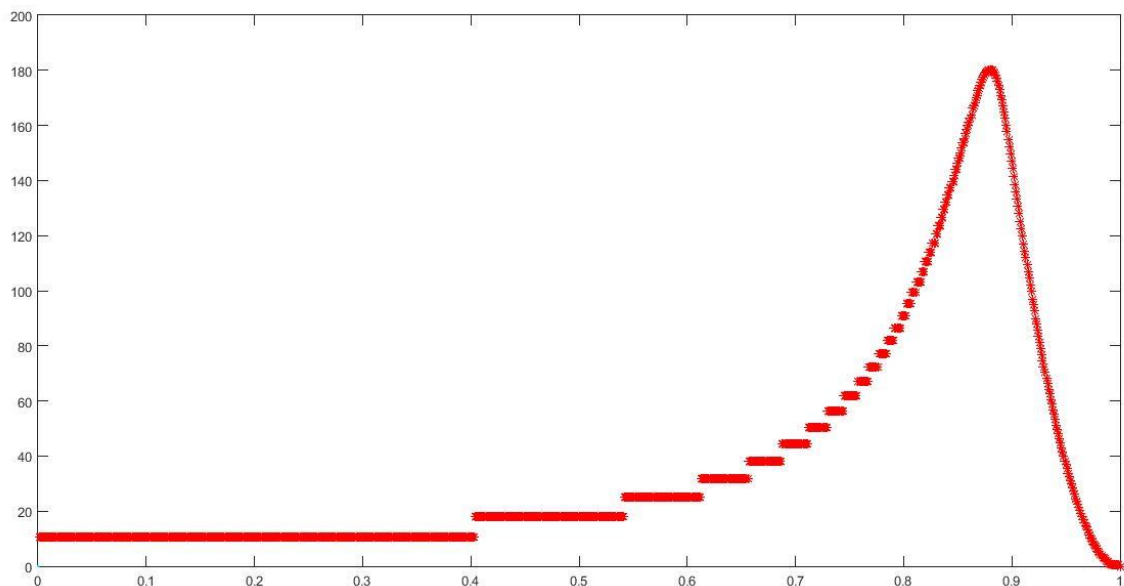
for V = 0.1 to V = 43.6,

I is calculated using IV curve.

Hence, Effective R is calculated for every point.

Step 2: Considering Boost Convertor,

$R_{eff} = R_{load} * (1-d)^2$

R_{load} is chosen as 500 Ω.

Step 3: Power vs duty curve is also plotted using above formula (taking $R_{load} = 500$ Ω).

For PSO ::

$P^{k+1} = P^k + V^k$

$V^{K+1} = w*V^k + c1*r*(P_l - P^k) + c2*r*(P_g - P^k)$

Simulation 1 ::

Variables => w=0.1

        $C1 = 0.2$

        $C2 = 0.2$

        $R = 0.4$

Particles => $D1 = 0.40$ (both side of d_{max})

        $D2 = 0.60$

        $D3 = 0.95$

Result :: Particles converges (within 2% of P_{mpp}) after 43rd Iteration.

Simulation 2::

Variables => w=0.1

        $C1 = 0.2$

        $C2 = 0.2$

        $R = 0.4$

Particles => $D1 = 0.40$ (Same side of d_{max})

        $D2 = 0.60$

        $D3 = 0.80$

Result :: failed to converge even after 50 iterations (Pmax reached = 91W)

Simulation 3::

Variables => w=0.5 (improved Parameter values)

        $C1 = 0.5$

        $C2 = 0.5$

        $R = 0.5$

Particles => $D1 = 0.40$ (Same side of d_{max})

        $D2 = 0.60$

        $D3 = 0.80$

Result :: failed to converge even after 50 iterations (Pmax reached = 139.6W, Velocity is very small).

Simulation 4::

Variables => w=0.5
C1 = 0.5
C2 = 0.5
R = 5 (made x10 from the last simulation)

Particles => D1 = 0.40 (Same side of d_{max})
D2 = 0.60
D3 = 0.80

Result :: failed to converge even after 50 iterations (Same Result as last Simulation)

Simulation 5::

Variables => w=0.9 (High Value of W)
C1 = 0.5
C2 = 0.5
R = 5

Particles => D1 = 0.40 (Same side of d_{max})
D2 = 0.60
D3 = 0.80

Result :: Particles got MPP in 11 iterations but keep oscillating around Mpp with big variations

Simulation 6::

Variables => w=0.9 (High Value)
C1 = 0.5
C2 = 0.5
R = 1 (Moderate Value)

Particles => D1 = 0.40 (Same side of d_{max})
D2 = 0.60
D3 = 0.80

Result :: got MPP in 8 iterations. Failed to converge but oscillations are not large (about 10% of P_{mpp}. May be useful with Shifting MPP).

Simulation 7::

Variables => w=0.5

C1 = 0.5

C2 = 0.5

R = 1 (moderate value)

Particles => D1 = 0.40 (both side of d_{max})

D2 = 0.60

D3 = 0.95

Result :: converges in 10 iterations. Remain at MPP for next iterations (static)

Simulation 8::

- ## Test 1

Variables => w=0.5

C1 = 0.5

C2 = 0.5

R = 1

Particles => D1 = 0.91 (chosen Randomly)

D2 = 0.18

D3 = 0.26

Result :: got MPP in 7 Iterations and all converges in 10 iterations

- ## Test 2

Variables => w=0.5

C1 = 0.5

C2 = 0.5

R = 1

Particles => D1 = 0.579 (chosen Randomly)

D2 = 0.549

D3 = 0.144

Result :: failed to find MPP. All got converge in local minima(long flat portion of P-d curve)

- ## Test 3,4,5… only 50-60% chances of convergence at MPP (always converges at local points)

Simulation 9::

Test 1

Variables => w=0.5

           C1 = random

           C2 = random

           R = 1 (moderate value)

Particles => D1 = 0.69 (All random)

           D2 = 0.58

           D3 = 0.81

Result :: converges in 8 iterations… got MPP in 11 iterations…(remain closely converged)

Test 2

Variables => w=0.5

           C1 = random

           C2 = random

           R = 1 (moderate value)

Particles => D1 = 0.756 (All random)

           D2 = 0.555

           D3 = 0.898

Result :: got MPP in 3rd iteration and converges in 10 iterations…(remain closely converged)

Test 3

Variables => w=0.5

           C1 = random

           C2 = random

           R = 1 (moderate value)

Particles => D1 = 0.64 (All random)

           D2 = 0.74

           D3 = 0.43

Result :: trapped in local max…

Test 4

Variables => w=0.5

           C1 = random

           C2 = random

           R = 1 (moderate value)

Particles => D1 = 0.16 (All random)

D2 = 0.75

D3 = 0.87

Result :: got MPP in 6th iteration and converges in 11 iterations…(remain closely converged)

Test 5

Variables => w=0.5

        C1 = random

        C2 = random

        R = 1 (moderate value)

Particles => D1 = 0.57 (All random)

        D2 = 0.17

        D3 = 0.95

Result :: got MPP in 7th iteration and converges in 13 iterations…(remain closely converged)

Test 6

Variables => w=0.5

        C1 = random

        C2 = random

        R = 1 (moderate value)

Particles => D1 = 0.76 (All random)

        D2 = 0.93

        D3 = 0.10

Result :: got MPP in 9th iteration and converges in 13 iterations…(remain closely converged)

Test 7

Variables => w=0.5

        C1 = random

        C2 = random

        R = 1 (moderate value)

Particles => D1 = 0.12 (All random)

        D2 = 0.26

        D3 = 0.25

Result :: trapped at local MPP