Economic Dispatch Without Loss

Solution of λ iteration method without loss (Algorithm)

Case (i) operating limits of power generation are not specified

$$\lambda = \frac{P_D + \sum_{i=1}^{N} \frac{b_i}{2a_i}}{\sum_{i=1}^{N} \frac{1}{2a_i}}$$

Step 2: compute P_{gi} corresponding to λ using the equation

$$C_i(P_{Gi}) = aP^2{}_{Gi} + b\,P_{Gi} + c_i$$

$$\text{Incremental cost (IC)} = \frac{dC_i(P_{gi})}{dP_{gi}} = 2a_iP_{gi} + b_i = \lambda$$

$$P_{gi} = \frac{\lambda - b_i}{2a_i}$$

Step 3: compute $\sum_{i=1}^{n} P_{gi}$

Step 4: check for power balance equation $P_D = \sum_{i=1}^{N} P_{Gi}$

The power balance equation is satisfied, then the optimum solution is obtained otherwise go to next step.

Step 5:

$$if \sum_{i=1}^{N} P_{gi} < P_D$$

Assign λ + Δ λ (i.e.,) increment λ and go to step 2

$$if \sum_{i=1}^{N} P_{gi} > P_D$$

Assign λ - Δ λ (i.e.,) increment λ and go to step 2

Where

$$\Delta\lambda = \frac{\Delta P}{\sum_{i=1}^{N} \frac{1}{2a_i}}$$

ΔP is change in demand

Case (ii) operating limits of power generation are specified

Step 1 : Assign the initial values of λ or calculate using

$$\lambda = \frac{P_D + \sum_{i=1}^{N} \frac{b_i}{2a_i}}{\sum_{i=1}^{N} \frac{1}{2a_i}}$$

Step 2: compute P_{gi} corresponding to λ using the equation

$$P_{gi} = \frac{\lambda - b_i}{2a_i}$$

Step 3: if the computed P_{gi} satisfies the operating limits,

$$P_{Gi\,min} < P_{Gi} < P_{Gi\,max}$$

For i = 1,2,…., N, then the optimum solution is obtained, otherwise go to next step

Step 4: if P_{gi} violates the operating limits, hen fix the generation at the respective limit.

$$P_{Gi} < P_{Gi,min}, then\ Fix\ P_{Gi} = P_{Gi,min}$$

$$P_{Gi} > P_{Gi,max}, then\ Fix\ P_{Gi} = P_{Gi,max}$$

Step 5: Redistribute the remaining system load P_D

$$P_{D\,new} = P_{D\,old} - sum\ of\ fixed\ generations\ to\ the\ remaining\ unit$$

Step 6: compute λnew using $P_{D\,new}$ and compute the remaining generations using

$$P_{gi} = \frac{\lambda_{new} - b_i}{2a_i}$$

Step 7: check whether optimal conditions is satisfied. If the condition is satisfied then stop. Otherwise release the generation schedule fixed at $P_{Gi,min}$ or $P_{Gi,max}$ of those units not satisfying the optimal condition. Include these units in the remaining units and modify the new power demand

$$P_{D\,new,1} = P_{D\,new} + sum\ of\ fixed\ generators$$ not satisfying the optimal condition

And go to step 6

EDC neglecting losses flowchart