ECONOMIC LOAD DISPATCH

Objectives

- Develop a generalized program for solving economic load dispatch problem with the following conditions:
  - Transmission line losses are neglected
  - Generator limits are not considered

Simulation Tool

- Scripting languages like Python, Octave, MATLAB

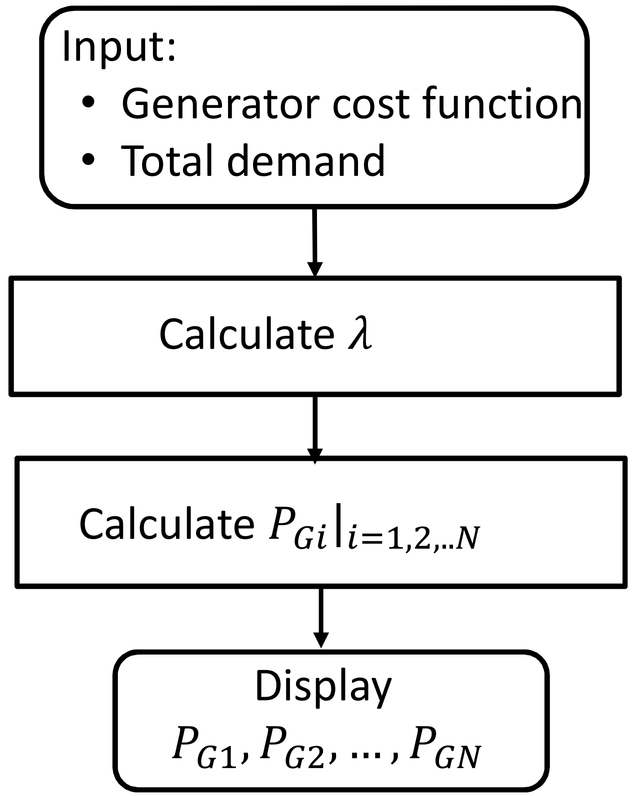
Mathematical Model

- Solve P_{Gi} using the following equations:
  - Co-ordination equation:
    - $\frac{\partial C_i}{\partial P_{Gi}} = \lambda$
  - Constraints:
    - $\sum_{i=1}^{N} P_{Gi} = P_D$
    - All loads should be served

Inputs

- Cost function matrix of the generation system of the form:
  - $C = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ - & - & - \\ a_N & b_N & c_N \end{bmatrix}$
    - Where cost of each generator is of the form: $C_i = a_i + b_i P_{Gi} + c_i P_{Gi}^2$
    - N is the total number of generators
- Total demand P_D

Flow chart


Input:
• Generator cost function
• Total demand
Calculate λ
Calculate $P_{Gi}|_{i=1,2,..N}$
Display
$P_{G1}, P_{G2}, \ldots, P_{GN}$

Calculation of λ and P_{Gi}

- $\frac{\partial C_i}{\partial P_{Gi}} = \lambda \;\; where \; C_i = a_i + b_i P_{Gi} + c_i P_{Gi}^2$
  - $\frac{\partial C_i}{\partial P_{Gi}} = b_i + 2c_i P_{Gi} = \lambda$
  - $\boxed{P_{Gi} = \frac{\lambda - b_i}{2c_i}}$
- But $\sum P_{Gi} = P_D$
  - $P_D = \sum \frac{\lambda - b_i}{2c_i} = \lambda \sum \frac{1}{2c_i} - \sum \frac{b_i}{2c_i}$
  - $\boxed{\lambda = \frac{P_D + \sum \frac{b_i}{2c_i}}{\sum \frac{1}{2c_i}}}$

Sample inputs and outputs

- Inputs:
  - $C = \begin{bmatrix} 150 & 25 & 0.100 \\ 180 & 30 & 0.150 \\ 200 & 20 & 0.125 \end{bmatrix}$
  - $P_D = 100$

- Outputs:
  - $\lambda = 32.8378$
  - $P_G = [39.1892 \quad 9.4595 \quad 51.3514]$