EE 585 (Power System Operation and Control)

Quiz 1 Solution

A power plant consists of 3 generating units having the following fuel-costs:

$$FC_1 = 30 + 18P_1 + 0.035P_1^2$$

$$FC_2 = 32 + 22P_2 + 0.025P_2^2$$

$$FC_3 = 34 + 26P_3 + 0.020P_3^2$$

If P_1 = 400 MW for economic operation of the whole plant, determine P_2, and P_3.

Solution

The incremental costs are derived as follows:-

$$IFC_1 = \frac{dFC_1}{dP_1} = 18 + 0.07P_1$$

$$IFC_2 = \frac{dFC_2}{dP_2} = 22 + 0.05P_2$$

$$IFC_3 = \frac{dFC_3}{dP_3} = 26 + 0.04P_3$$

For P_1 = 400 MW , $IFC_1 = 18 + 0.07 \times 400 = 46$

Therefore, for economic operation $IFC_1 = IFC_2 = IFC_3 = 46$

$$22 + 0.05P_2 = 46 \Rightarrow P_2 = \frac{46 - 22}{0.05} = 480\ MW$$

$$26 + 0.04P_3 = 46 \Rightarrow P_3 = \frac{46 - 26}{0.04} = 500\ MW$$