EXPERIMENT NO 6

OBJECTIVE

Load sharing between two interconnected power systems

SOFTWARE USED

MATLAB

THEORY

To determine the economic distribution of load amongst the different units of a plant, the variable operating costs of each unit must be expressed in terms of its power output. The fuel cost is the main cost in a thermal or nuclear unit. Then the fuel cost must be expressed in terms of the power output. Other costs, such as the operation and maintenance costs, can also be expressed in terms of the power output. Fixed costs, such as the capital cost, depreciation etc., are not included in the fuel cost.

The fuel requirement of each generator is given in terms of the Rupees/hour. Let us define the input cost of an unit- i , f_i in Rs./h and the power output of the unit as P_i . Then the input cost can be expressed in terms of the power output as

$$f_i = \frac{a_i}{2} {P_i}^2 + b_i P_i + C_i$$

The operating cost given by the above quadratic equation is obtained by approximating the power in MW versus the cost in Rupees curve. The incremental operating cost of each unit is then computed as

$$\lambda_i = \frac{df_i}{dP_i} = a_i P_i + b_i$$

Let us now assume that only two units having different incremental costs supply a load. There will be a reduction in cost if some amount of load is transferred from the unit with higher incremental cost to the unit with lower incremental cost.

PROBLEM STATEMENT

Incremental fuel costs in rupees per MWh for a plant consisting of two units are

$$\frac{dC_1}{dP_{G_1}} = 0.20P_{G_1} + 40$$

$$\frac{dC_2}{dP_{G_2}} = 0.25P_{G_2} + 30$$

Assume that both units are operating at all times, and total load varies from 40 MW to 250 MW and the maximum and minimum loads on each unit are to be 125 and 20 MW respectively. How will the load be shared between the two units as the system load vanes over the full range? What are the corresponding values of the plant incremental costs.

CONCLUSION

The MATLAB code for the above problem is run and executed. It can be seen that the load is transferred from the less efficient unit to the more efficient unit thereby reducing the total operation cost. The load transfer will continue till the incremental costs of both the units are same. This will be optimum point of operation for both the units.

REFERENCES

[1]. Stevenson Jr, W. D. (1982). *Elements of Power System Analysis*, (4th), Mc-Graw Hill Higher Education.

[2]. Hadi Saadat, "*Power System Analysis*", Milwaukee School of Engineering, McGraw Hill, 1999.

[3]. Kothari D. P., Nagrath I. J., *"Modern Power System Analysis"*, Mc-Graw Hill Higher Education.

APPENDIX

MATLAB CODE

```
% MATLAPB program for optimum loading of generators
% Pd stands for load demand.
% alpha and beta arrays denote alpha beta coefficients
% for given generators.
Pd=231.25
alpha = [0.20
         0.25]
beta= [40
       30]
% initial guess for lamda
lamda=20
lamdapreva = lambda
eps=1
deltalamda = 0.25
Pgmax=[125 125]
Pgmin=[20 20]
Pg=100*ones(n,1)
while abs( sum(Pg)-Pd)>eps
for i = 1 : n ,
Pg(i) =(lamda-beta(i))/alpha(i) ;
if Pg(i) >Pgmax(i)
   Pg(i)=Pgmax(i);
end
if Pg(i)< Pgmin(i)
   Pg(i) = Pgmin(i) ;
end
end
if(sum(Pg)-Pd) < 0
lamdapreva=lamda;
lamda=lamda-deltalamda;
else
lamdaprev =lamda
lamda=lamda-detlalamda;
end
end
disp('The final value of lamda is')
lamdaprev
disp ('The distribution of load shared by two units is ' )
Pg
```