

Lab Project 3: Economic Dispatch with Losses

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Problem Description:

The following case file is given for a 9-bus system in Mathpower format.

MATPOWER is a public domain Matlab based software which can be downloaded from www.pserc.cornell.edu/matpower/ or <http://blackbird.pserc.cornell.edu/matpower/2.0/download.html>.

1. Write a Matlab program that reallocates generation to obtain the most economic dispatch without losses and without inequality constraints.
2. Write a Matlab program that computes the loss coefficients.
3. Write a Matlab program that reallocates generation to obtain the most economic dispatch with losses and without inequality constraints.
4. Compare results with those obtained by the optimal power flow 'runopf' provided by Mathpower.

Test your program using data from the 4-bus system, see Stevenson-Grainger example 13.3 and 13.4.. Then run it for the 9-bus system and evaluate results.

Hint: Read the casefile with Mathpower. Then export Mathpower variables, for example the active and reactive generation and loads or the Ybus matrix by modifying the function call as

```
[MVAbase, bus, gen, branch, Ybus, success, et]= myrunpf('case9Mod')
```

and by incorporating the following function calls in your economic dispatch program:

```
[PQ, PV, REF, NONE, BUS_I, BUS_TYPE, PD, QD, GS, BS, BUS_AREA, VM, ...  
VA, BASE_KV, ZONE, VMAX, VMIN, LAM_P, LAM_Q, MU_VMAX, MU_VMIN] = idx_bus;
```

```
[[F_BUS, T_BUS, BR_R, BR_X, BR_B, RATE_A, RATE_B, ...  
RATE_C, TAP, SHIFT, BR_STATUS, PF, QF, PT, QT, MU_SF, MU_ST] = idx_brch;
```

```
[GEN_BUS, PG, QG, QMAX, QMIN, VG, MBASE, ...  
GEN_STATUS, PMAX, PMIN, MU_PMAX, MU_PMIN, MU_QMAX, MU_QMIN] = idx_gen;
```

These will allow you to work with the same variables for the generation and load as Mathpower.

Split the first 3 tasks among the team members; then combine function calls for the program.

```

function [baseMVA, bus, gen, branch, areas, gencost] = case9Saadet
%CASE9      Power flow data for a 9 bus, 3 generator case.
%      Please see 'help caseformat' for details on the case file format.
%
%%----- Power Flow Data -----%%

%% system MVA base
baseMVA = 100;

%% bus data
% bus_i  type  Pd  Qd  Gs  Bs  area  Vm  Va  baseKV  zone  Vmax  Vmin
bus = [
    1  3  0  0  0  0  1  1  0  345 1  1.1 0.9;
    2  2  20 10  0  0  1  1  0  345 1  1.1 0.9;
    3  1  25 15  0  1  1  1  0  345 1  1.1 0.9;
    4  1  10  5  0  3  1  1  0  345 1  1.1 0.9;
    5  1  40 20  0  0  1  1  0  345 1  1.1 0.9;
    6  1  60 40  0  0  1  1  0  345 1  1.1 0.9;
    7  2  10  5  0  0  1  1  0  345 1  1.1 0.9;
    8  1  80 60  0  0  1  1  0  345 1  1.1 0.9;
    9  1  100 80  0  0  1  1  0  345 1  1.1 0.9;
];

%% generator data
% bus Pg  Qg  Qmax  Qmin  Vg  mBase  status  Pmax  Pmin
gen = [
    1  0  0  50  0  1.03  100 1  250 50;
    2  80 0  250  0  1.04  100 1  300 50;
    7  120 0  100  0  1.01  100 1  270 50;
];

%% branch data
% fbus  tbus  r  x  b  rateA  rateB  rateC  ratio  angle  status
branch = [
    1  2  0.018  0.054 0.0045  250 250 250 0  0  1;
    1  8  0.014  0.036 0.0030  250 250 250 0  0  1;
    2  9  0.006  0.030 0.0028  150 150 150 0  0  1;
    2  3  0.013  0.036 0.0030  300 300 300 0  0  1;
    3  4  0.010  0.050 0.0000  150 150 150 0  0  1;
    4  5  0.018  0.056 0.0000  250 250 250 0  0  1;
    5  6  0.020  0.060 0.0000  250 250 250 0  0  1;
    6  7  0.015  0.045 0.0038  250 250 250 0  0  1;
    6  9  0.002  0.066 0.0000  250 250 250 0  0  1;
    7  8  0.032  0.076 0.0000  250 250 250 0  0  1;
    7  9  0.022  0.065 0.0000  250 250 250 0  0  1;
];

%%----- OPF Data -----%%
%% area data
areas = [
    1  5;
];

%% generator cost data
% 1  startup shutdown  n  x0  y0  ... xn  yn
% 2  startup shutdown  n  c(n-1)  ... c0
gencost = [
    2  1500  0  3  0.009  6.7 240;
    2  2000  0  3  0.005  6.1 220;
    2  3000  0  3  0.008  6.5 240;
];

return;

```