
Homework Set 3 - Solutions

ECE 530

October 7, 2015

1

In Lecture 8, we talked about how opening a circuit breaker is the only way to directly control power flow in transmission lines. Changing generation is one way we can indirectly change the flow, but we don't have the same level of control over generation for intermittent renewable sources compared with conventional sources.

Other acceptable answers connect Lecture 8 topics (ACE, AGC, voltage regulation, etc) to results of a decrease in fossil-fuel based generation/increase in renewable base generation.

Instead of taking the inverse of J, use LU decomposition:

```

while (norm(deltaX,inf) > .001)
    f = subs(fOfX, toSub, daSub);
    J = subs(Jacob,toSub, daSub);

    % LU Factorization
    s = length(J);
    U = J;
    L = zeros(s,s);
    for j=1:s,
        L(j,j) = 1;
        for i=(1+j):s
            c = U(i,j)/U(j,j);           %Scaling
            U(i,j:s)=U(i,j:s)-U(j,j:s)*c;
            L(i,j) = c;
        end
    end

    b = f;
    for i = 2:s
        for j = 1:(i-1)
            b(i) = b(i) - L(i,j)*b(j);
        end
    end
    for i = s:-1:1
        for j = (i+1):s
            b(i) = b(i)-U(i,j)*b(j);
        end
        b(i) = b(i)/U(i,i);
    end

    deltaX = -b;
    x_New = transpose(daSub)+deltaX;

```

Results should be the same as in Homework 2.

3

Set $V_4 = 1.05$, make V_3 a variable, but still use the Q_4 power flow equation.

Results:

	Iteration1	Iteration2	Iteration3	Iteration4
	-0.3199	-0.36342	-0.37137	-0.37155
	-0.00035608	-0.014195	-0.015641	-0.01567
	-0.04186	-0.050688	-0.051999	-0.052024
	-0.073228	-0.078164	-0.078869	-0.078883
	0.94768	0.87768	0.86848	0.86828
	1.062	1.0826	1.0844	1.0845
	1.0156	0.99461	0.9925	0.99246

	Infinity Norm			
output =	Iteration1	Iteration2	Iteration3	Iteration4
	0.3199	0.070004	0.0092	0.00019365

	Power Output	
Power	Bus	Value (in p.u.)
P	1	3.928091
Q	1	0.236695
Q	3	3.884149

4

rowPerm = [D, A, C, G, I, B, E, H, J, F]
lines added: B-C, I-F, E-F \implies 6 fills

5

rowPerm = [D, A, C, B, E, G, H, F, I, J]
lines added: B-C, E-F, I-F \implies 6 fills

Vertex	Degree								
A	2	2							
B	3	3	3	3					
C	2	2	2						
D	1								
E	3	3	3	2	2				
F	5	4	4	4	4	3	3	2	
G	2	2	2	2	2	2			
H	3	3	3	3	3	2	2		
I	2	2	2	2	2	2	2	2	
J	3	3	3	3	3	3	3	2	