Lab Report

Shape

Description automatically generated with low confidence

Alexandria university

Faculty of Engineering

Electrical Power and Machines Engineering Program

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Load Flow Analysis

Using

Gauss-Seidel Method

# **Introduction**

I am using the Gauss-Seidel numerical method to obtain an approximate solution to the 3-bus system provided in the image below.

A diagram of a machine

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I calculated the voltages magnitudes and angles for the 3 buses and the injected power for the slack bus (BUS 1).

# **The Results**

A screenshot of a computer

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A zoomed in version of the resultsA screenshot of a computer

Description automatically generated

The input parameters for these results:

A computer code with green text

Description automatically generated

# **The code (A Text Version Provided at the End)**

The input parameters:

A computer code with green text

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Y Bus Calculations:

A white background with green and black numbers and symbols

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Gauss-Seidel iterations:A screenshot of a computer program

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Slack Bus power calculation:

A computer code with black text

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Displaying the Results:

A screenshot of a computer program

Description automatically generated

function Gauss\_Seidel()

% Line impedances

Z12 = 0.05 + 0.8i;

Z13 = 0.5 + 1.2i;

Z23 = 0.02 + 1i;

% Complex power injections (S) at each bus

S\_IN\_MVA = [0; -50-20i; -60-25i]; % Set the slack bus power to 0

BASE\_MVA = 100;

S = S\_IN\_MVA ./ BASE\_MVA;

% Admittance matrix

Y = zeros(3, 3);

% Calculate the diagonal elements of Y

Y(1, 1) = 1 / Z12 + 1 / Z13;

Y(2, 2) = 1 / Z12 + 1 / Z23;

Y(3, 3) = 1 / Z13 + 1 / Z23;

% Calculate the off-diagonal elements of Y

Y(1, 2) = -1 / Z12;

Y(2, 1) = Y(1, 2);

Y(1, 3) = -1 / Z13;

Y(3, 1) = Y(1, 3);

Y(2, 3) = -1 / Z23;

Y(3, 2) = Y(2, 3);

% Initial values

V = ones(3, 1); % Voltage magnitudes

V(1) = 1.05;

% Maximum number of iterations and tolerance

maxIterations = 100;

% Gauss-Seidel iterations

for iter = 1:maxIterations

% Iterate for each bus, excluding the slack bus (starting from bus 2)

for i = 2:3

current = 0;

for j = 1:3

if(j ~= i)

current = current + Y(i,j) \* V(j);

end

end

V(i) = ( (conj(S(i))/conj(V(i))) - current) / Y(i,i);

end

end

I = 0;

for k = 1:3

I = I + (Y(1,k) \* V(k));

end

SlackBus\_Power = conj(conj(V(1)) \* I);

SlackBus\_Power = SlackBus\_Power \* BASE\_MVA;

% Display results

disp('the Y Bus Matrix in (p.u):');

disp(Y);

disp('Slack Bus Power in MW:');

disp(real(SlackBus\_Power));

disp('Slack Bus Reactive Power in MVAR:');

disp(imag(SlackBus\_Power));

disp('Bus Voltages in (p.u):');

disp(V);

disp('Bus Voltages Magnitudes in (p.u):');

disp(abs(V));

disp('Bus Voltages Angles (in degrees):');

disp(rad2deg(angle(V)));

end