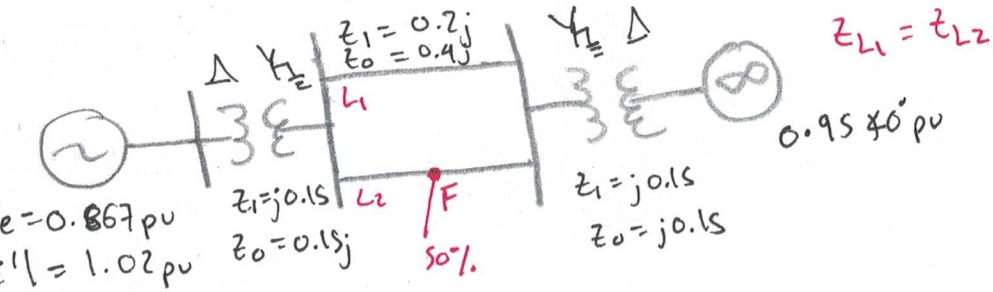
Análisis de la transferencia de potencia debido a fallas en la red.

Davalos Gonzalez Erick Christopher.



$P_e = 0.867$ pu

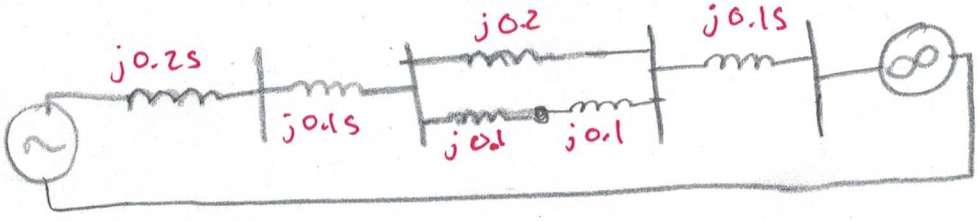
$|E'| = 1.02$ pu

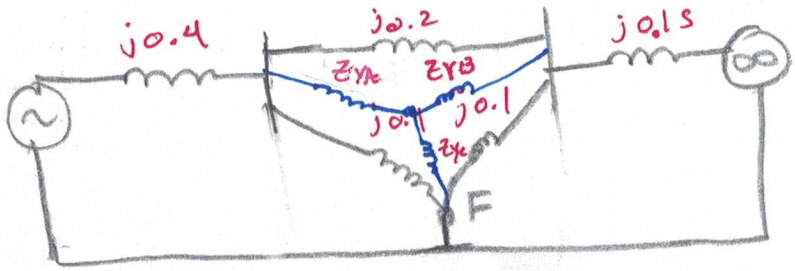
$jx_d' = j0.25$

$z_2 = j0.19$

$H = 4.5 \frac{kW \cdot s}{kVA}$

* Red de secuencia (+) – Falla trifasica (3ϕ).





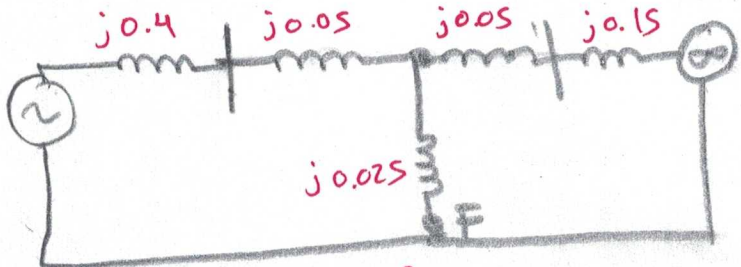
$$z_{YA} = \frac{(0.2)(0.1)}{0.4} =$$

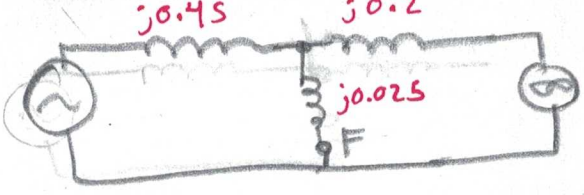
$$= 0.05j$$

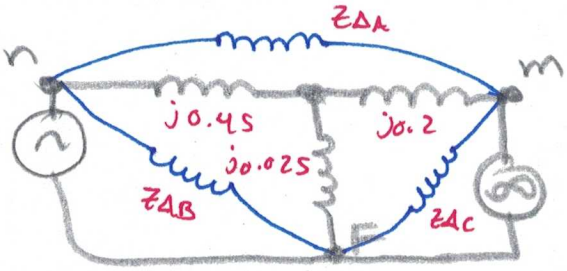
$$z_{YB} = 0.05j$$

$$z_{YC} = \frac{(0.1)(0.1)}{0.4}$$

$$z_{YC} = j0.025.$$







$$Z_{\Delta A} = \frac{0.106250}{0.025} = 4.25j$$

$$Z_{\Delta B} = \frac{0.106250}{0.2} = 0.531250 \quad ; \quad Z_{\Delta C} = \frac{0.106250}{0.45} = 0.23611$$

$Z_{\Delta A} = Z_{TRANS}$ * Reactancia de transferencia. $\boxed{Z_{TRANS} = 4.25j}$

* Potencia transferida debido a falla trifasica (entre nodos).

$$P_{nm3\phi} = \frac{(1.02)(0.95)}{4.25}\sin(\delta) = 0.228\sin(\delta)$$

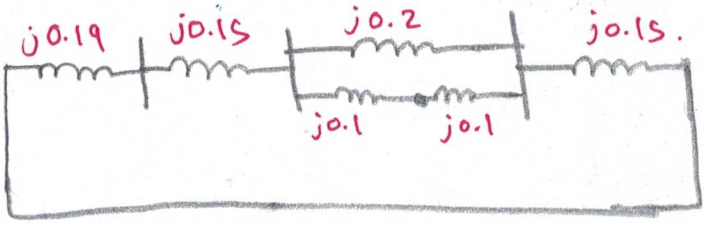
Las fallas posteriores a analizar serán:

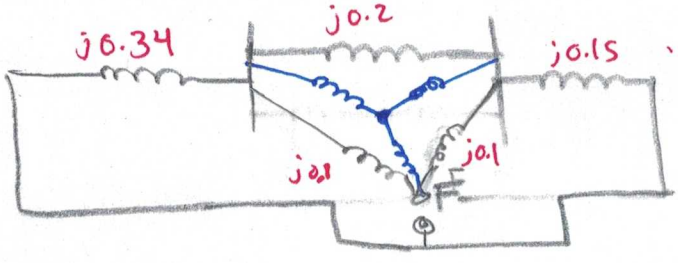
- Falla doble linea
- Falla doble linea a tierra
- Falla monofasica.

Ya se tiene la falla más severa (falla trifasica) y la red de secuencia positiva, la metodologia será: Calcular las redes de secuencia y luego interconectar las redes dependiendo el tipo de falla, al final se calcularan las potencias transferidas entre buses para un angulo de $0 \leq \delta \leq 180°$. (Grafica en MATLAB).

En la siguiente pagina se comienza analizando las redes de secuencia negativa y cero.

Red de secuencia negativa. (-)

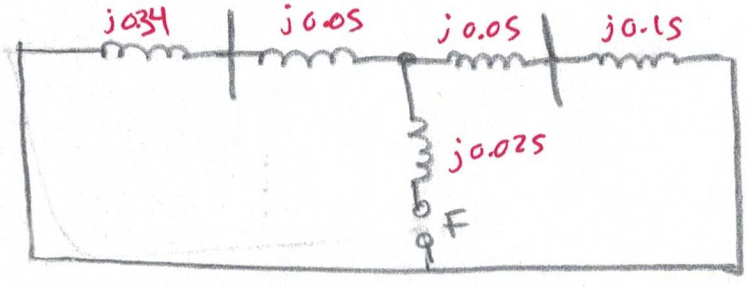


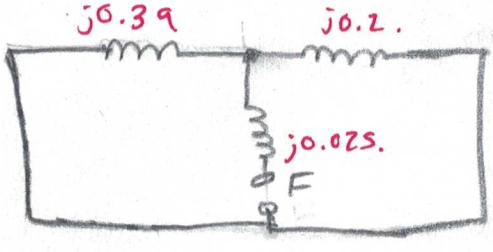


$$ZY_A = 0.05$$

$$ZY_B = 0.05$$

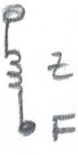
$$ZY_C = 0.025.$$



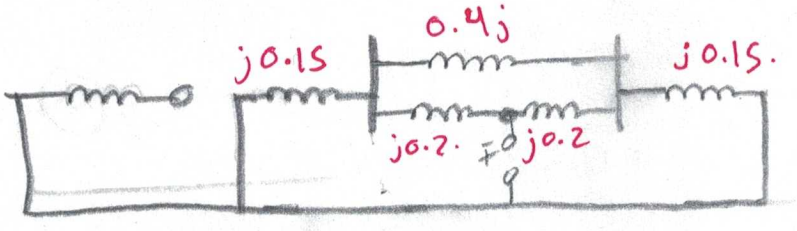


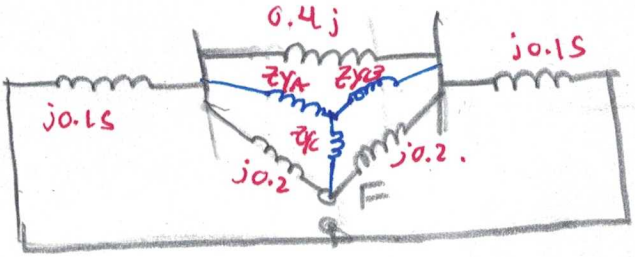
$$\rightarrow Z_{2T} = \frac{1}{\frac{1}{j0.39} + \frac{1}{j0.2}} + 0.025j$$

$$Z_{2T} = 0.157203j$$



Red de secuencia cero (ø)

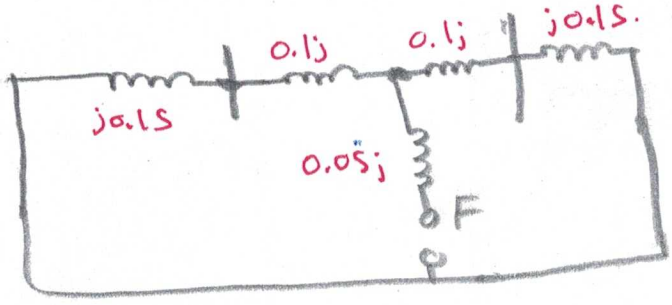


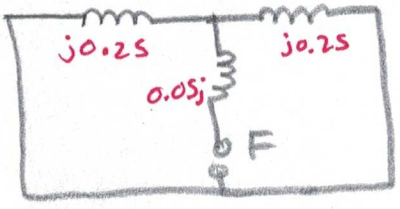


$$Z_{yA} = \frac{(0.4)(0.2)}{0.8} = 0.1j$$

$$Z_{yB} = 0.1j$$

$$Z_{yC} = \frac{(0.2)(0.2)}{0.8} = 0.05j$$



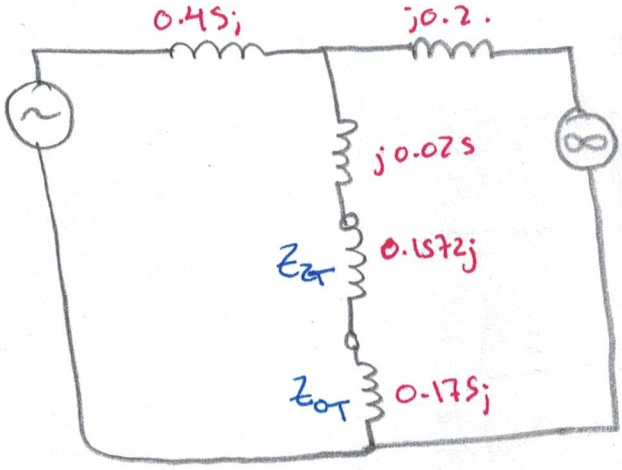


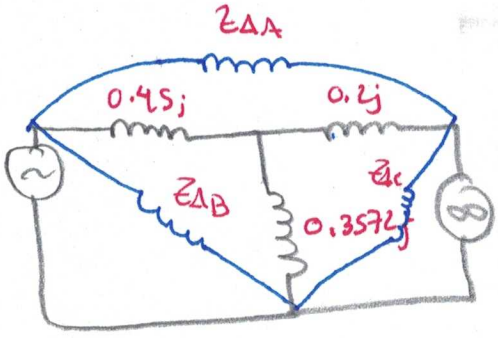
$$Z_{0T} = \frac{1}{\frac{1}{0.25j} + \frac{1}{0.25j}} + 0.05j$$

$$Z_{0T} = 0.175j$$

* Falla monofasica

Para la falla monofasica las tres redes de secuencia se conectan en serie al punto de falla.

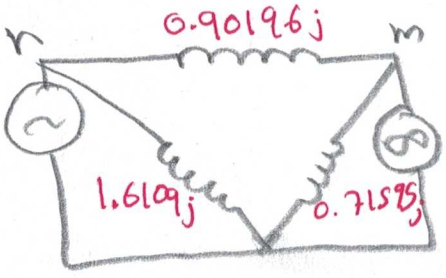




$$Z_{\Delta A} = \frac{0.32718}{0.3572} = 0.90196.$$

$$Z_{\Delta B} = \frac{0.32718}{0.2} = 1.6109$$

$$Z_{\Delta C} = \frac{0.32718}{0.45} = 0.715956.$$



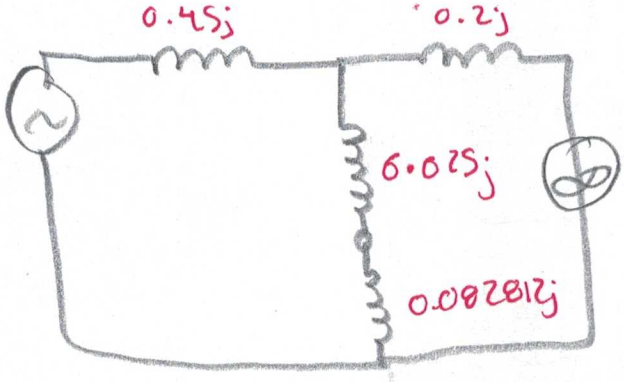
$$Z_{TRAS\ \phi} = 0.90196j$$

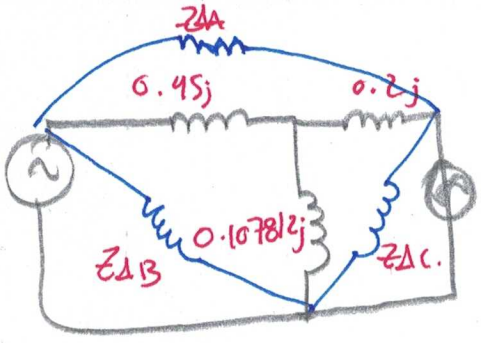
$$P_{rm\phi} = \frac{(1.02)(0.95)}{0.90196}\sin(\delta) = 1.0743227\sin(\delta)$$

* Falla doble línea a tierra.

Para una falla doble línea a tierra las redes de secuencia se conectan en paralelo.

$$Z_{1-eq} = \frac{(Z_{2T})Z_{0T}}{Z_{2T}+Z_{0T}} = \frac{(0.1572)(0.175)}{0.1572+0.175} = 0.082812j$$

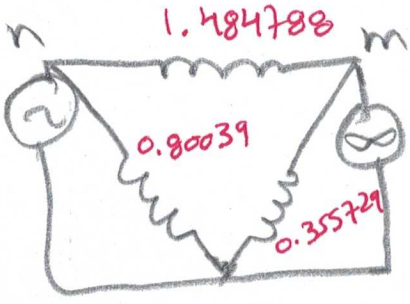




$$Z_{\Delta A} = \frac{0.160078}{0.107812} = 1.484788$$

$$Z_{\Delta B} = \frac{0.160078}{0.2} = 0.80039$$

$$Z_{\Delta C} = \frac{0.160078}{0.45} = 0.355729.$$

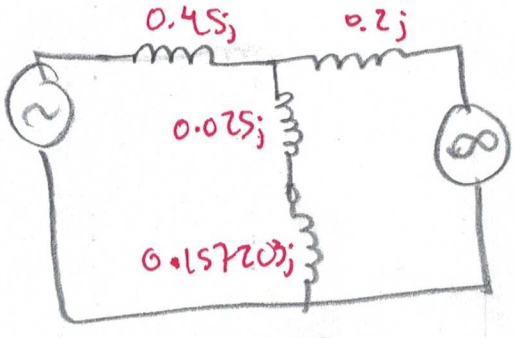


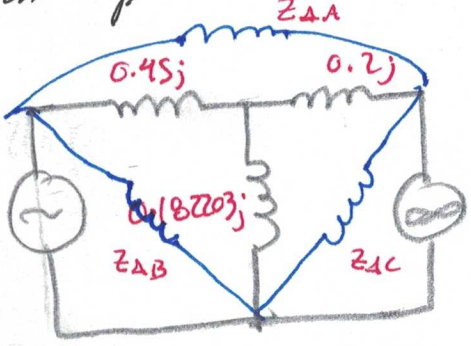
$$Z_{THAS} = 1.484788$$

$$P_{max\,2\phi-G} = \frac{(1.02)(0.95)}{1.484788}\sin(\delta) = 0.652618\sin(\delta)$$

*Falla entre dos líneas.

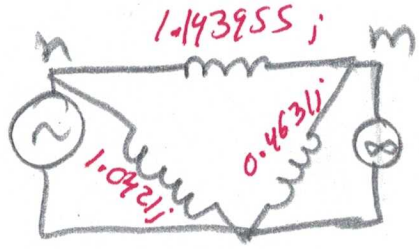
Para esta falla las redes de secuencia positiva y negativa se conectan en paralelo.





$$Z_{\Delta A} = \frac{0.208432}{0.182203} = 1.143955 \qquad Z_{\Delta C} = \frac{0.208432}{0.45} = 0.463182$$

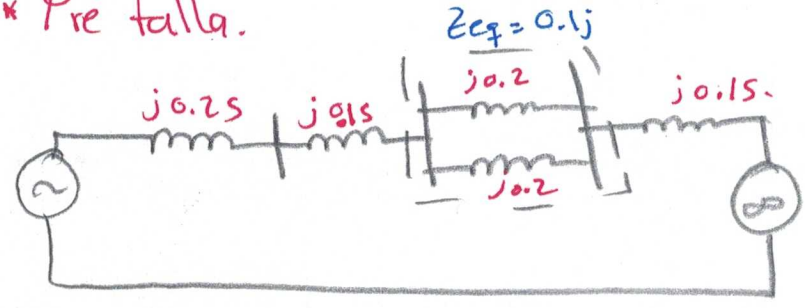
$$Z_{AB} = \frac{0.208432}{0.2} = 1.042160$$

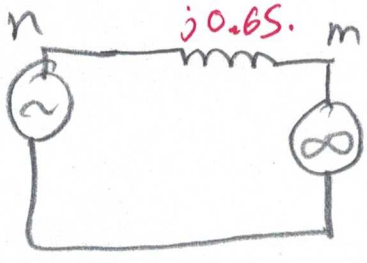


$Z_{TRAS} = 1.143955j$

$$P_{nmLL} = \frac{(1.02)(0.95)}{1.143955}\sin(\delta) = 0.847061\sin(\delta)$$

* Pre falla.

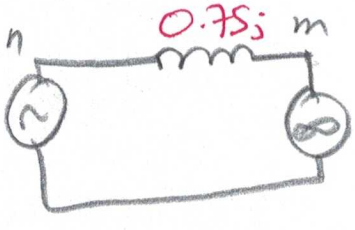




$$P_{nmpre} = \frac{(1.02)(0.95)}{0.65}\sin(\delta)$$

$$P_{nmpre} = 1.490769\sin(\delta)$$

* Post falla.



$$P_{nmpost} = \frac{(1.02)(0.95)}{0.75}\sin(\delta)$$

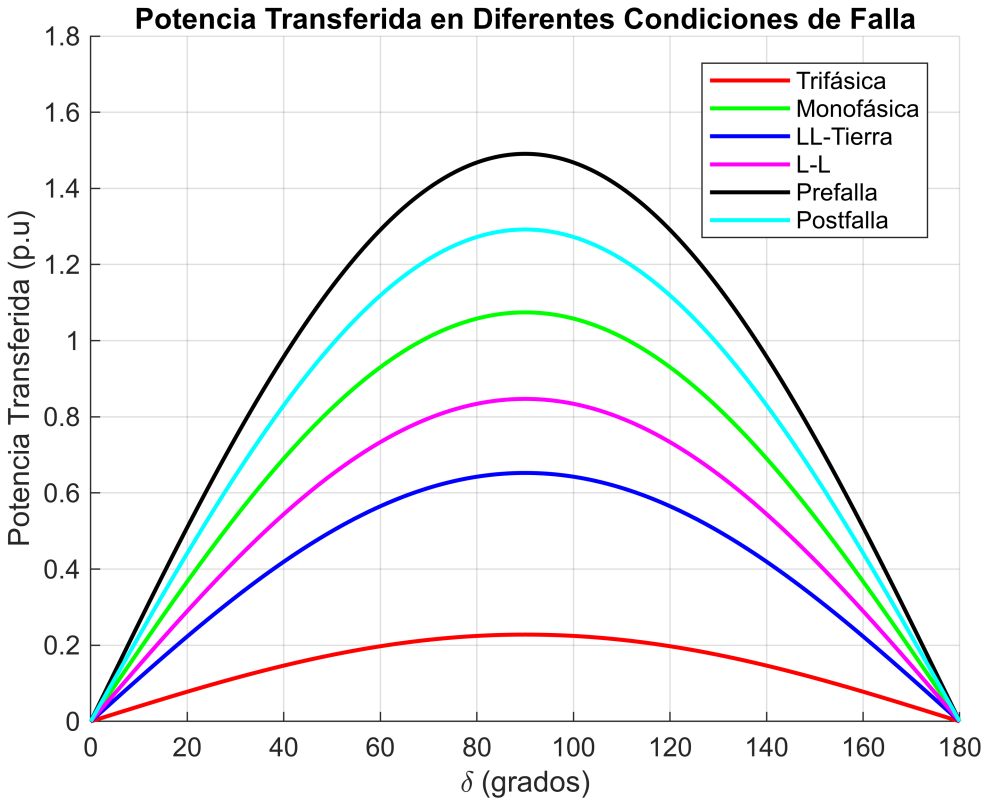
$$P_{nmpost} = 1.292\sin(\delta)$$

```
clc; clear; close all;

deltarad = linspace(0, pi, 1000);
deltadeg = deltarad * (180/pi);

% Potencias transferidas en diferentes condiciones
Pnm3 = 0.228 * sin(deltarad);      % Falla trifásica
Pnm1 = 1.0743227 * sin(deltarad);  % Falla monofásica
Pnm2g = 0.652618 * sin(deltarad);  % Falla doble línea a tierra
Pnm2 = 0.847061 * sin(deltarad);   % Falla línea a línea
Pnmpre = 1.490769 * sin(deltarad); % Condición de prefalla
Pnmpost = 1.292 * sin(deltarad);   % Condición de postfalla

figure;
hold on;
plot(deltadeg, Pnm3, 'r', 'LineWidth', 1.5);
plot(deltadeg, Pnm1, 'g', 'LineWidth', 1.5);
plot(deltadeg, Pnm2g, 'b', 'LineWidth', 1.5);
plot(deltadeg, Pnm2, 'm', 'LineWidth', 1.5);
plot(deltadeg, Pnmpre, 'k', 'LineWidth', 1.5);
plot(deltadeg, Pnmpost, 'c', 'LineWidth', 1.5);
xlabel('\delta (grados)');
ylabel('Potencia Transferida (p.u)');
title('Potencia Transferida en Diferentes Condiciones de Falla');
legend({'Trifásica', 'Monofásica', 'LL-Tierra', ...
        'L-L', 'Prefalla', 'Postfalla'}, ...
        'Location', 'Best');
grid on;
xlim([0 180]);
ylim([0 1.8]);
hold off;
```


Potencia Transferida en Diferentes Condiciones de Falla
Trifásica
Monofásica
LL-Tierra
L-L
Prefalla
Postfalla
Potencia Transferida (p.u)
δ (grados)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0
20
40
60
80
100
120
140
160
180