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% Valores Base
Upb=150;
Usb=31.5;
Utb=6.3;
Sb=120;
Zpb=Upb^2/Sb
Zpb = 187.5000

Zab=7*j;
zab=Zab/Zpb
zab = 0 + 0.0373i

% Línea larga
l=1e-3; %Hy
c=8e-9; %F
L=240; %km
Z=(0+j*l*100*pi())*L
Y=(0+j*c*100*pi())*L
z=Z/Zpb
y=Y*Zpb
tita=sqrt(z*y)
Al=cosh(tita)
Bl=z*sinh(tita)/tita
Cl=y*sinh(tita)/tita
Dl=cosh(tita)
Z = 0 +75.3982i
Y = 0 +6.0319e-004i
z = 0 + 0.4021i
y = 0 + 0.1131i
tita = 0 + 0.2133i
Al = 0.9773
Bl = 0 + 0.3991i
Cl = 0 + 0.1122i
Dl = 0.9773

%trafo 150/31.5/6.3 kV 120/120/60 MVA
% xps=11.82% xst=26.57% xpt=36.83% en base 120 MVA
xps=0.118;
xst=0.266;
xpt=0.368;
xp=((xps+xpt-xst)/2)*j
xs=((xps+xst-xpt)/2)*j
xt=((xpt+xst-xps)/2)*j
xp = 0 + 0.1100i
xs = 0 + 0.0080i
xt = 0 + 0.2580i

ured=160/Upb
ps=80/Sb
qs=ps*0.75
us=32/Usb
ss=ps+j*qs
ured = 1.0667
ps = 0.6667
qs = 0.5
us = 1.0159
ss = 0.6667 + 0.5i

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% opción 1, compensar localmente en A (OPCIÓN CORRECTA)

%parte 1.1 cuadripolo en xs

sos=ss+xs/us^2*abs(ss)^2

sos = 0.6667 + 0.5054i

uo=us+xs/us*conj(ss);

muo=abs(uo)

muo = 1.0198

qos=imag(sos)

qos = 0.5054

%parte 1.2 cuadripolo en Line+Zab+Xp

At=A1

At = 0.9773

Bt=B1+A1*(xp+zab)

Bt = 0 + 0.5431i

pop=real(sos)

pop = 0.6667

%utilizo formulas escalar de U1 y hallo Q2:

%A^2*U2^2 + B^2/U2^2*(P2^2 + Q2^2) + 2*A*B*(P2*cos(b-a) + Q2*sin(b-a))

%=U1^2

coef1=abs(Bt)^2/muo^2

coef1 = 0.2836

coef2=2*abs(At)*abs(Bt)*sin(angle(Bt)-angle(At))

coef2 = 1.0616

coef3=abs(At)^2*muo^2 + abs(Bt)^2/muo^2*pop^2+

coef3 = -0.0183

2*abs(At)*abs(Bt)*pop*cos(angle(Bt)-angle(At))-ured^2

[q1,q2]=poli_2(coef1,coef2,coef3)

q1 = 0.0171

qop=q1

q2 = -3.7606

qot=qop-qos

qop = 0.0171

qot = -0.4882

%parte 1.3 cuadripolo en xt

%utilizo formulas complejas de U1 y S1:

pot=0

pot = 0

sot=-j*qot

sot = 0 + 0.4882i

sbancos1=sot+xt/muo^2*abs(sot)^2;

qbancos1=imag(sbancos1)

qbancos1 = 0.5474

Qbancos1=qbancos1*Sb

Qbancos1 = 65.68 MVar

% opción 2) compensar en B (OPCIÓN INCORRECTA)

%parte 2.1 cuadripolo Zab+Xp+Xs

%utilizo formulas complejas de U1 y S1:

Z=zab+xp+xs

Z = 0 + 0.1553i

sba=ss+Z/us^2*abs(ss)^2

sba = 0.6667 + 0.6045i

ub=us+Z/us*conj(ss);

mub=abs(ub)

mub = 1.0971

qba=imag(sba)

qba = 0.6045

pba=real(sba)

pba = 0.6667

%parte 2.2 cuadripolo Linea

%utilizo formulas escalar de U1 y hallo Q2:

%A^2*U2^2 + B^2/U2^2*(P2^2 + Q2^2) + 2*A*B*(P2*cos(b-a) + Q2*sin(b-a))

%=U1^2

coef1=abs(B1)^2/mub^2

coef1 = 0.1323

coef2=2*abs(A1)*abs(B1)*sin(angle(B1)-angle(A1))

coef2 = 0.7801

coef3=abs(A1)^2*mub^2 + abs(B1)^2/mub^2*pop^2+

coef3 = 0.0707

2*abs(A1)*abs(B1)*pop*cos(angle(B1)-angle(A1))-ured^2

q1 = -0.0921

[q1,q2]=poli_2(coef1,coef2,coef3)

q2 = -5.8030

qbred=q1

qbred = -0.0921

qb=qbred-qba

qb = -0.6966

%parte 2.3 cuadripolo en xpt

%utilizo formulas complejas de U1 y S1:

pb=0

pb = 0

sb=-j*qb

sb = 0 + 0.6966i

sbancos2=sb+xpt/mub^2*abs(sb)^2;

qbancos2=imag(sbancos2)

qbancos2 = 0.8449

Qbancos2=qbancos2*Sb

Qbancos2 = 101.4 MVAr