ZÁPADOČESKÁ
UNIVERZITA
V PLZNI

FAKULTA ELEKTROTECHNICKÁ ZČU V PLZNI

Přípravné výpočty stability alternátoru

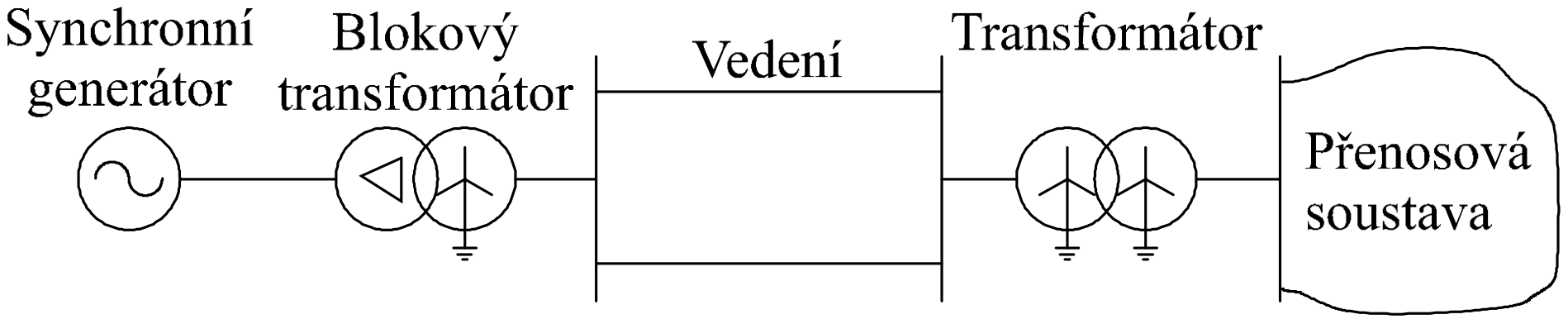
Karel Noháč

ZČU, FEL, KEE 2019

UNIVERSITY
OF WEST BOHEMIA

FAKULTA
ELEKTROTECHNICKÁ
ZÁPADOČESKÉ
UNIVERZITY
V PLZNI

Parametry zařízení



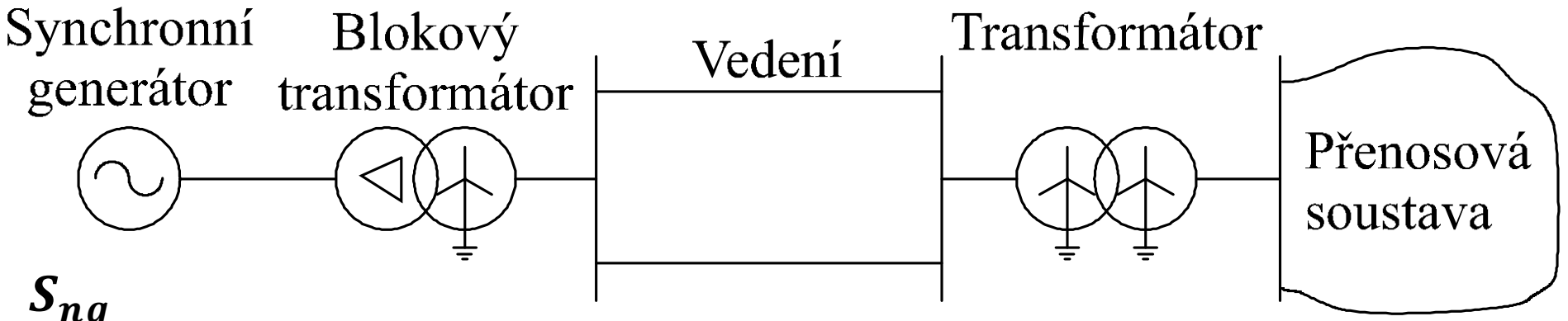
$$i = \sqrt{-1}$$

$$Un$$

$$Unf = \frac{Un}{\sqrt{3}}$$

```
% Napeti

i=sqrt(-1)

Un=400

Unf=Un/sqrt(3)
```

Parametry zařízení



$\boldsymbol{S_{ng}}$

$\cos(\boldsymbol{\varphi})$

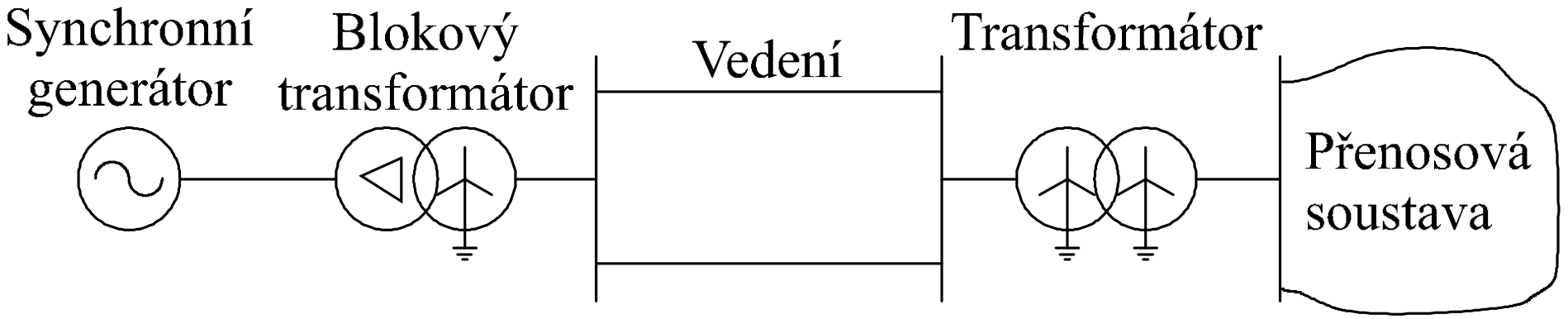
$\boldsymbol{P_{ng} = S_{ng} \cdot \cos(\varphi)}$

$$\boldsymbol{X_d = \frac{x_d}{100} \cdot \frac{Un^2}{Sng}}$$

$$\boldsymbol{X_d{}' = \frac{x_d{}'}{100} \cdot \frac{Un^2}{Sng}}$$

```
% Generator
Sng=100
CosFi=0.8
Png=Sng*CosFi
Xd= (120/100)*(Un^2/Sng)
Xdc=( 30/100)*(Un^2/Sng)
```

Parametry zařízení



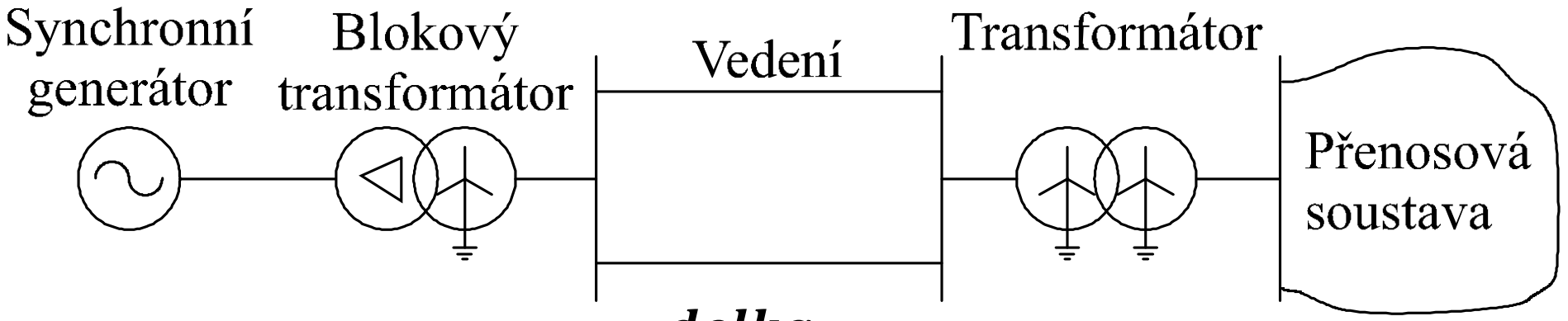
S_{nt1}

u_{kt1}

$$X_{t1} = \frac{u_{kt1}}{100} \cdot \frac{U_n^2}{S_{nt1}}$$

```
% Transformator T1

Snt1=100

Ukt1=10

Xt1=(Ukt1/100)*(Un^2/Snt1)
```

Parametry zařízení



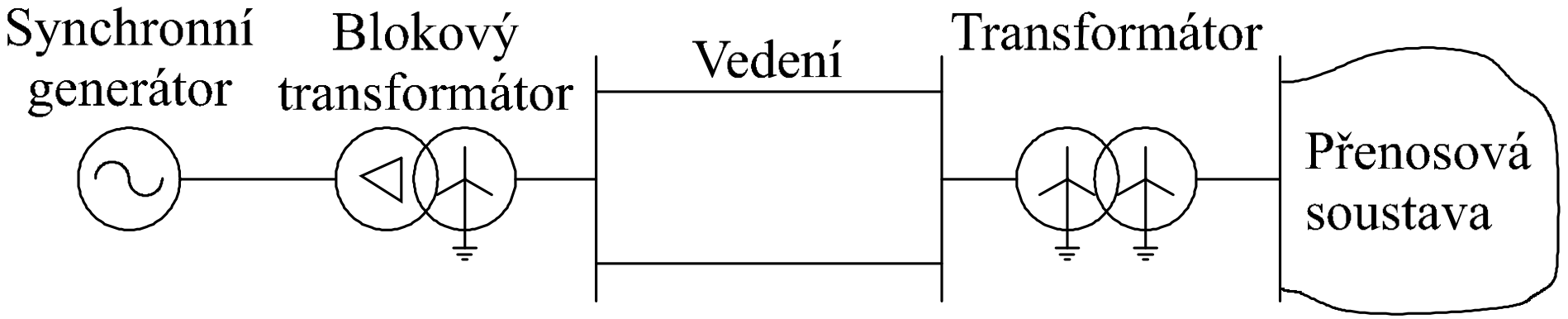
$$\boldsymbol{delka}$$

$$\boldsymbol{X_{v1} = delka \cdot x_{v1} \frac{U_n^2}{U_V^2}}$$

$$\boldsymbol{Xv = \frac{Xv1}{2}}$$

```
% Vedeni
delka=50
Xv1=delka*0.3/110^2*Un^2
Xv=Xv1/2
```

Parametry zařízení



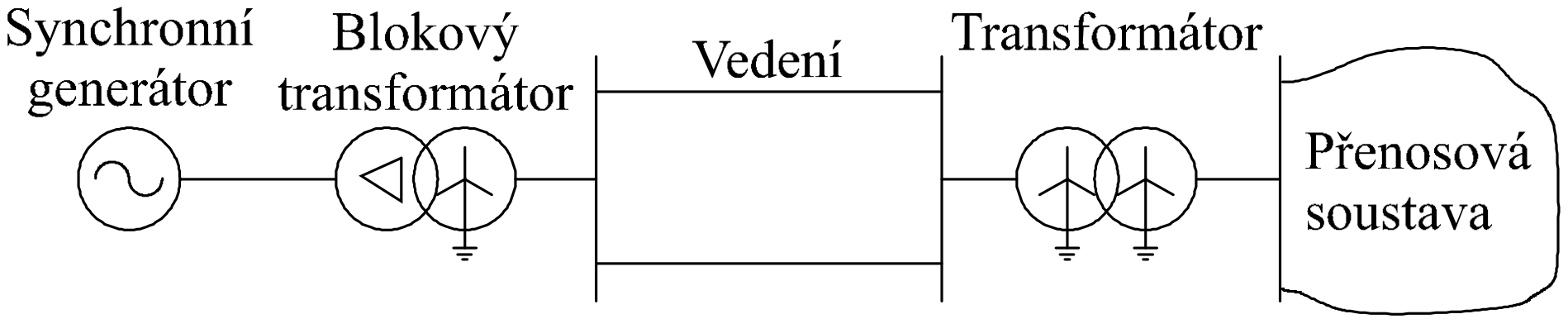
S_{nt2}

u_{kt2}

$$X_{t2} = \frac{U_{kt2}}{100} \cdot \frac{U_n^2}{S_{nt2}}$$

```
% Transformator T2
Snt2=100
Ukt2=10
Xt2=(Ukt2/100)*(Un^2/Snt2)
```

Parametry zařízení



S_k

C

$$X_s = C \cdot \frac{U_n^2}{S_k}$$

```
% Sit

Sk=10000

KoefC=1.1

Xs=KoefC*(Un^2/Sk)
```

Předporuchový stav

$$P_{ng0} = 1.00 \cdot P_{ng}$$
$$P_t = P_{ng0}$$
$$\vartheta = \frac{75}{180}\pi$$
$$\vartheta' = \vartheta$$

$$X_{suma} = |X_d + X_{t1} + X_v + X_{t2} + X_s|$$
$$X_{suma}{}' = |X_d{}' + X_{t1} + X_v + X_{t2} + X_s|$$

```
% Vypocet predporuchoveho stavu, pocatecni zatizeni 100%

% Zvolit zatezny uhel

Png0=1.00*Png

Pt=Png0

Theta=75/180*pi

Thetac=Theta


% Celkova vazebni reaktance

Xsuma =abs(Xd +Xt1+Xv+Xt2+Xs)

Xsumac=abs(Xdc+Xt1+Xv+Xt2+Xs)
```

Předporuchový stav

$$E = \frac{P_{ng0}}{3 \cdot U_{nf} \cdot \sin(\vartheta)} X_{suma}$$

```
% Vypocet potrebneho nabuzeni E a E'
E= Png0/3/Unf*Xsuma/sin(Theta)
```

$$E' = \frac{P_{ng0}}{3 \cdot U_{nf} \cdot \sin(\vartheta)} X_{suma}{}'$$

```
Ec=Png0/3/Unf*Xsumac/sin(Theta)
```

$$P_{gkontrola} = 3 \frac{E \cdot Unf}{X_{suma}} \sin(\vartheta)$$

```
Pgkontrola=3*E*Unf/Xsuma*sin(Theta)
```

$$P_{gkontrola}{}' = 3 \frac{E' \cdot Unf}{X_{suma}{}'} \sin(\vartheta)$$

```
Pgckontrola=3*Ec*Unf/Xsumac*sin(Thetac)
```

Zkrat v polovině vedení

$$X_a = \frac{X_{v1}\frac{X_{v1}}{2}}{X_{v1} + \frac{X_{v1}}{2} + \frac{X_{v1}}{2}}$$

$$X_b = \frac{X_{v1}\frac{X_{v1}}{2}}{X_{v1} + \frac{X_{v1}}{2} + \frac{X_{v1}}{2}}$$

$$X_c = \frac{\frac{X_{v1}}{2} \cdot \frac{X_{v1}}{2}}{X_{v1} + \frac{X_{v1}}{2} + \frac{X_{v1}}{2}}$$

```
% Zkrat v polovine vedeni Xv1

% Nahrada trojuhelnika hvezdou
Xa=Xv1*Xv1/2/(Xv1+Xv1/2+Xv1/2)
Xb=Xv1*Xv1/2/(Xv1+Xv1/2+Xv1/2)
Xc=Xv1/2*Xv1/2/(Xv1+Xv1/2+Xv1/2)
```

$$X_l = X_d{}' + X_{t1} + X_a$$

$$X_r = X_b + X_{t2} + X_s$$

$$X_{sumazkrat} = X_l + X_r + \frac{X_l \cdot X_r}{X_c}$$

```
Xl=Xdc+Xt1+Xa
Xr=Xb+Xt2+Xs
Xsumazkrat=abs(Xl + Xr + Xl*Xr/Xc)
```

Odpojení poruchy

$$X_{sumaodpojeno} = |i \cdot X_{suma} - X_v + X_{v1}|$$

$$X_{sumaodpojeno2} = |X_{dc} + X_{t1} + X_{v1} + X_{t2} + X_s|$$

$$P_{max1} = 3\frac{Ec \cdot Unf}{X_{suma}'}$$

$$P_{max2} = 3\frac{Ec \cdot Unf}{X_{sumazkrat}}$$

$$P_{max3} = 3\frac{Ec \cdot Unf}{X_{sumaodpojeno}}$$

$$Y_{12} = \frac{1}{X_{suma}'}$$

$$Y_{12zkrat} = \frac{1}{X_{sumazkrat}}$$

$$Y_{12odpojeno} = \frac{1}{X_{sumaodpojeno}}$$

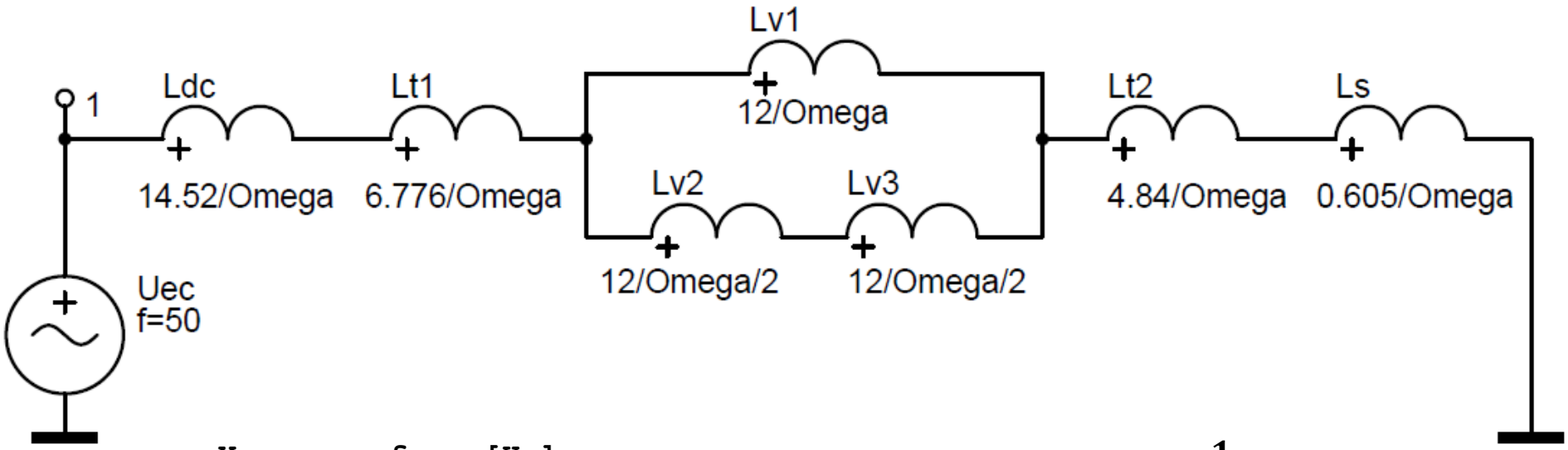
```
% Odpojeni poruchy

Xsumaodpojeno=
        abs(i*Xsumac -Xv + Xv1)

Xsumaodpojeno2=
        abs(Xdc + Xt1 + Xv1 + Xt2 + Xs)
```

```
% Konecne alternativy maximalnich
dodavanych cinnych vykonu

Pmax1=3*Ec*Unf/Xsumac

Pmax2=3*Ec*Unf/Xsumazkrat

Pmax3=3*Ec*Unf/Xsumaodpojeno
```

```
% Kontrolni admitance

Y12=          1/Xsumac

Y12zkrat=     1/Xsumazkrat

Y12odpojeno=1/Xsumaodpojeno
```

Předporuchový stav

$$X_{suma} = |X_d + X_{t1} + X_v + X_{t2} + X_s|$$
$$X_{suma}' = |X_d' + X_{t1} + X_v + X_{t2} + X_s|$$

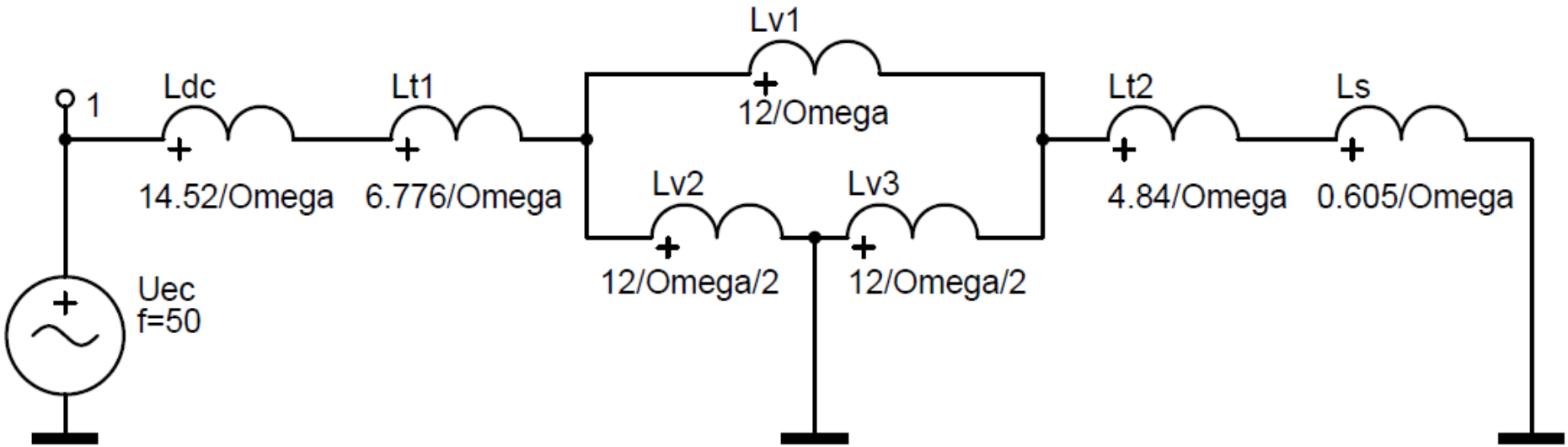



```
X ...    freq [Hz]
1 ...    MOD.I.Ldc
2 ...    DEG.I.Ldc
3 ...    MOD.I.Ls
4 ...    DEG.I.Ls

     X                1                2                3                4
5.000000e+001  3.054274e-002  2.700000e+002  3.054274e-002  2.700000e+002
```

$$Y_{12} = \frac{1}{X_{suma}'}$$

Zkrat v polovině vedení

$$X_{sumazkrat} = X_l + X_r + \frac{X_l \cdot X_r}{X_c}$$

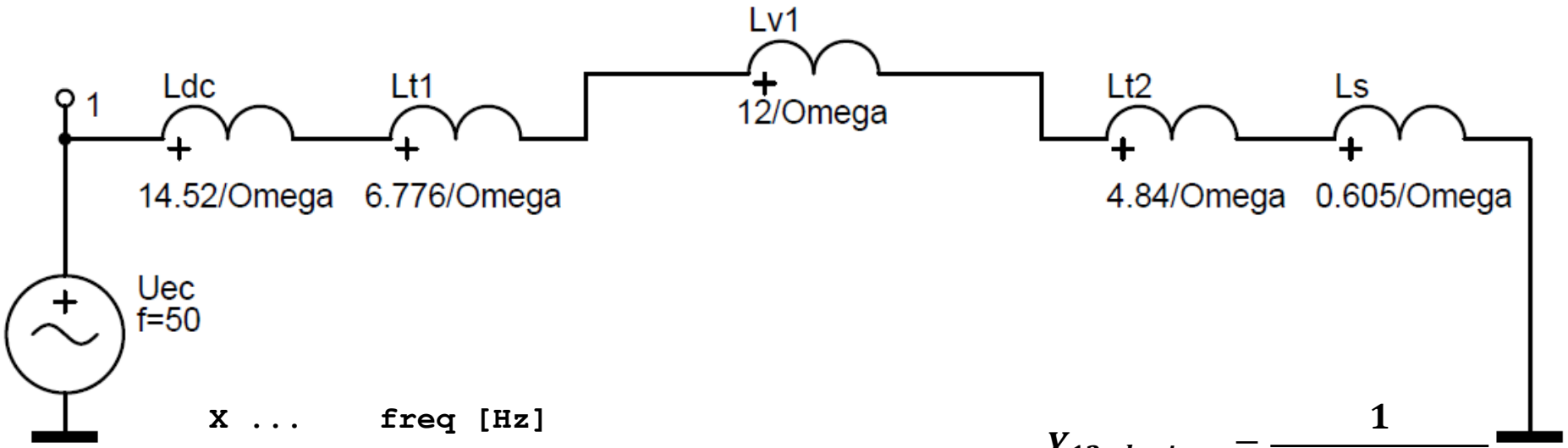



```
X ...    freq [Hz]
 1 ...    MOD.I.Ldc
 2 ...    DEG.I.Ldc
 3 ...    MOD.I.Ls
 4 ...    DEG.I.Ls

     X              1              2              3              4
5.000000e+001  3.910870e-002  2.700000e+002  5.898749e-003  2.700000e+002
```

$$Y_{12zkrat} = \frac{1}{X_{sumazkrat}}$$

Odpojení poruchy

$$X_{sumaodpojeno} = |X_{dc} + X_{t1} + X_{v1} + X_{t2} + X_s|$$




```
X ...    freq [Hz]
1 ...    MOD.I.Ldc
2 ...    DEG.I.Ldc
3 ...    MOD.I.Ls
4 ...    DEG.I.Ls

     X                1                2                3                4
5.000000e+001  2.581245e-002  2.700000e+002  2.581245e-002  2.700000e+002
```

$$Y_{12odpojeno} = \frac{1}{X_{sumaodpojeno}}$$