```
syms Vs Vr delta R X real
syms Is
```

Current is specified as:

```
Is=simplifyFraction((Vs*(cos(delta)+1i*sin(delta))-Vr)/(R+1i*X))
```

$$Is = \frac{Vs\cos(\delta) - Vr + Vs\sin(\delta)\,i}{R + X i}$$

Complex power is: Vs*conj(Is)

```
S=simplify(Vs*(cos(delta)+1i*sin(delta))*conj(Is))
```

$$S = -\frac{Vs\,(\cos(\delta)+\sin(\delta)\,i)\,(Vr - Vs\cos(\delta)+Vs\sin(\delta)\,i)}{R - X i}$$

Real power is: Re(complex power)

```
P=simplify(real(S))
```

$$P = \frac{Vs\,(R\,Vs - R\,Vr\cos(\delta) + Vr\,X\sin(\delta))}{R^2 + X^2}$$

Reactive power is: imag(complex power)

```
Q=simplify(imag(S))
```

$$Q = -\frac{Vs\,(Vr\,X\cos(\delta) - Vs\,X + R\,Vr\sin(\delta))}{R^2 + X^2}$$

Real power equation with resistance neglected:

```
P=simplify(real(subs(S,R,0)))
```

$$P = \frac{Vr\,Vs\sin(\delta)}{X}$$

Reactive power with resistance neglected:

```
Q=simplify(imag(subs(S,R,0)))
```

$$Q = \frac{Vs\,(Vs - Vr\cos(\delta))}{X}$$

Calculating values of real and reactive power with the line resistance included:

R=5.1842 Ohms X=129.605 Ohms Vs = Vr = 161kV delta = 0.01877218

```
Q=double(imag(subs(S,[Vs,Vr,R,X,delta],[161e3,161e3,5.1842,1.29605e2,0.01877218])))
```

```
Q =
   -1.147465859708760e+05
```

```
P=double(real(subs(S,[Vs,Vr,R,X,delta],[161e3,161e3,5.1842,1.29605e2,0.01877218])))
```

```
P =
   3.749625633195513e+06
```

Calculating values of real and reactive power with the line resistance neglected

R=0 Ohms X=129.605 Ohms Vs = Vr = 161kV delta = 0.01877218

```
Q=double(imag(subs(S,[Vs,Vr,R,X,delta],[161e3,161e3,0,1.29605e2,0.01877218])))
```

```
Q =
   3.523843935694449e+04
```

```
P=double(real(subs(S,[Vs,Vr,R,X,delta],[161e3,161e3,0,1.29605e2,0.01877218])))
```

```
P =
   3.754215496634348e+06
```

```

```

As can be seen the values of P for both cases are very close (approx 3.75MW). Bu the values for Q are very different.