

Електроенергетски вод са губицима

Figure 1: Електроенергетски далековод са губицима

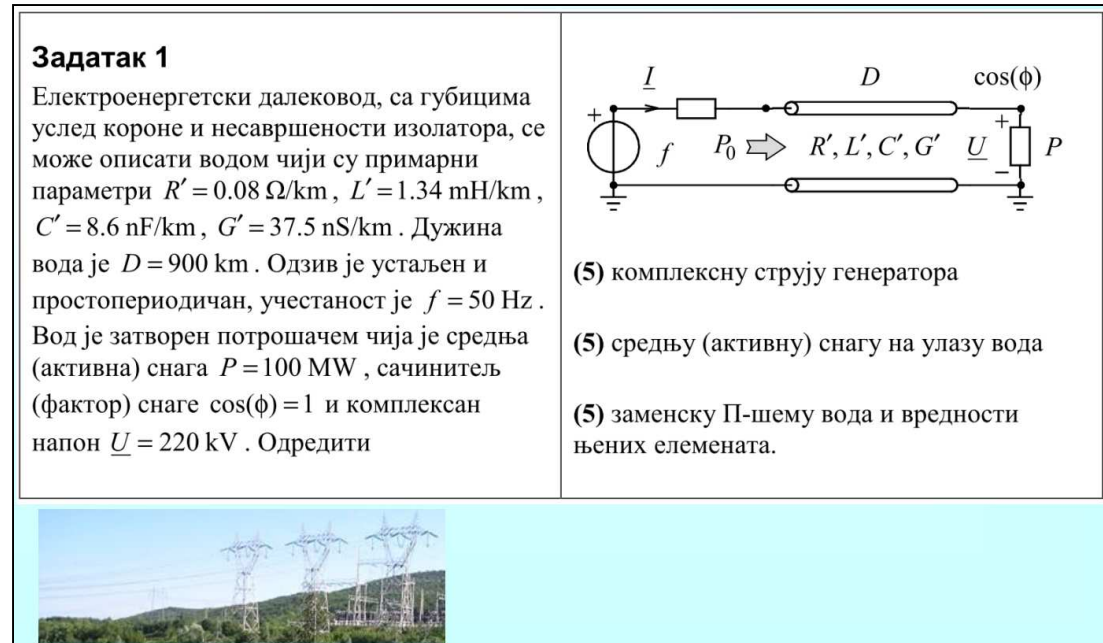
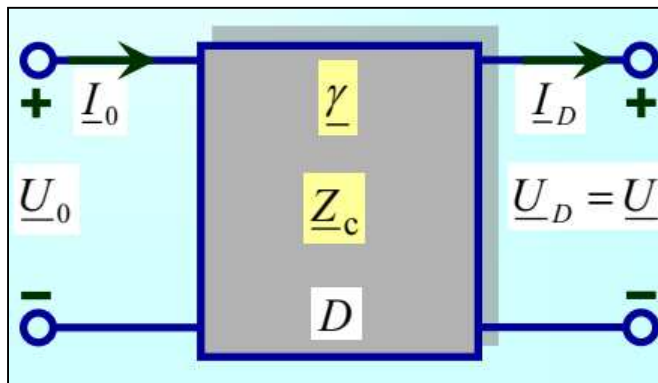


Figure 2:



```
(%i5) km: 1000; n: 1e-9; m: 1e-3; k: 1e3; M: 1e6;
```

```
(%o1) 1000
```

```
(%o2) 1.0 10-9
```

```
(%o3) 0.001
```

```
(%o4) 1000.0
```

```
(%o5) 1000000.0
```

```
(%i6) zamene: [Rp=0.08/km, Lp=1.34*m/km, Cp=8.6*n/km, Gp=37.5*n/km,  
D=900*km, f=50, P=100*M, cosPhi=1, U=220*k];
```

```
(%o6) [Rp=8.0 10-5, Lp=1.34 10-6, Cp=8.6000000000000001  
10-12, Gp=3.7500000000000001 10-11, D=900000, f=50, P=1.0  
108, cosPhi=1, U=220000.0]
```

```
(%i7) Zp: float(polarform(ev(Rp+%i*2.*pi*f*Lp, zamene)));
(%o7) 4.285074289040512 10-4
      %i atan(1.675 %pi)
      2.718281828459045

(%i8) Yp: float(polarform(ev(Gp+%i*2.*pi*f*Cp, zamene)));
(%o8) 2.702029915645956 10-9
      %i atan(22.93333333333333 %pi)
      2.718281828459045
```

Figure 3: Карактеристична импеданса

$$\underline{Z}_c = \sqrt{\frac{R' + j\omega L'}{G' + j\omega C'}}$$

```
(%i9) ZC: float(rectform(sqrt(Zp/Yp)));
(%o9) 396.7253914744759 - 34.58597640866502 %i
```

Figure 4: Коефицијент простирања

$$\underline{\gamma} = \sqrt{(R' + j\omega L')(G' + j\omega C')} = \alpha + j\beta$$

```
(%i10) Gama: float(rectform(sqrt(Zp*Yp)));
(%o10) 1.070563660684598 10-6 %i + 1.083205446666079 10-7

(%i11) GamaD: float(rectform(Gama*D)), zamene;
(%o11) 0.9635072946161387 %i + 0.09748849019994708
```

Figure 5: a11 параметар

$$\underline{a}_{11} = \underline{A} = \cosh(\underline{\gamma}D)$$

```
(%i12) a11: cosh(GamaD);
(%o12) 0.08018422722990864 %i + 0.57335716534993
```

Figure 6: a12 параметар

$$\underline{a}_{12} = \underline{B} = \underline{Z}_c \sinh(\underline{\gamma}D)$$

```
(%i13) a12: float(rectform(ZC*sinh(GamaD)));
(%o13) 325.4123847049449 %i + 50.64227661540107
```

Figure 7: a21 параметар

$$\underline{a}_{21} = \underline{C} = \underline{Y}_c \sinh(\underline{\gamma}D)$$

```
(%i14) a21: float(rectform((1/ZC) * sinh(GamaD)));
(%o14) 0.002076249184646369 %i - 4.055648675663819 10-5
```

Figure 8: a22 параметар

$$\underline{a}_{22} = \underline{D} = \cosh(\underline{\gamma}D)$$

```
(%i15) a22: cosh(GamaD);
(%o15) 0.08018422722990864 %i + 0.57335716534993

(%i16) Id: P/(U*cosPhi), zamene;
(%o16) 454.5454545454546
```

Figure 9: Комплексна струја генератора

$$\underline{I}_0 = \underline{C}\underline{U}_D + \underline{D}\underline{I}_D$$

```
(%i17) I0: float(rectform(ev(a21*U+a22*Id, zamene)));
(%o17) 493.222196635796 %i + 251.6944662544169
```

Figure 10: Комплексни напон на улазу у вод

$$\underline{U}_0 = \underline{A}\underline{U}_D + \underline{B}\underline{I}_D$$

```
(%i18) U0: float(rectform(ev(a11*U+a12*Id, zamene)));
(%o18) 165555.2503110094 %i + 149157.7930203487

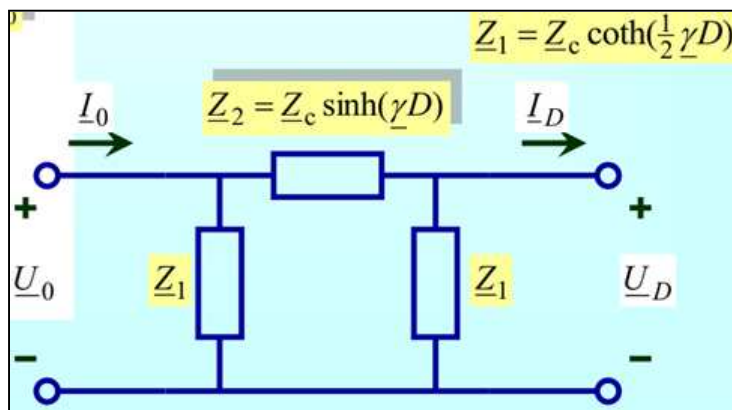
(%i19) S0: float(rectform(U0*conjugate(I0)));
(%o19) 1.191977153249286 108 - 3.189859395619788 107 %i
```

Figure 11: Средња (активна) и реактивна снага на улазу у вод

$$\underline{S}_0 = \underline{U}_0 (\underline{I}_0)^* = P_0 + jQ_0$$

```
(%i20) P: realpart(S0);
(%o20) 1.191977153249286 108
```

Figure 12: Заменска π-шема вода и вредности њених елемената



```
(%i21) Z1: float(rectform(ev(ZC*coth(Gama*D/2), zamene)));
```

```
(%o21) 23.80838416534208 - 758.2532777900506 %i
```

```
(%i22) Z2: float(rectform(ev(ZC*sinh(Gama*D), zamene)));
```

```
(%o22) 325.4123847049449 %i + 50.64227661540107
```