

# Braninove jednačine

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(%i1) Uz: A1*%e^(-s*Tprim*z)+A2*%e^(s*Tprim*z);
```

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(%o1) A2 %e^{Tprim s z} + A1 %e^{-Tprim s z}
```

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(%i2) Iz: -(1/(Lprim*s))*diff(Uz,z), Lprim=Zc*Tprim, ratsimp;
```

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(%o2) - \frac{{e}^{-Tprim s z} (A2 {e}^{2 Tprim s z} - A1)}{Zc}
```

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(%i3) jednacine: [U0=ev(Uz,z=0), I0=ev(Iz,z=0), Ud=ev(Uz,z=d),  
Id=ev(Iz,z=d)], Tprim=Tau/d;
```

```
(%o3) [U0=A2+A1, I0=- \frac{A2-A1}{Zc}, Ud=A2 {e}^{Tau s} + A1 {e}^{-Tau s}, Id  
= - \frac{{e}^{-Tau s} (A2 {e}^{2 Tau s} - A1)}{Zc}]
```

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(%i4) assume(Zc>0);
```

```
(%o4) [Zc>0]
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```
(%i5) Alzamenal: solve(jednacine[2], A1);
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(%o5) [A1=I0 Zc+A2]
```

```
(%i6) A2zamenal: solve([jednacine[3], jednacine[4]], [A1, A2]);
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```
(%o6) [[A1= \frac{(Id Zc+Ud) {e}^{Tau s}}{2}, A2= \frac{(Ud-Id Zc) {e}^{-Tau s}}{2}]]
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(%i7) U0jedinacina: ev(jednacine[1],Alzamenal), A2zamenal;
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```
(%o7) U0=(Ud-Id Zc) {e}^{-Tau s} + I0 Zc
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```
(%i8) U0zamena: solve(U0jedinacina, U0);
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(%o8) [U0={e}^{-Tau s} (I0 Zc {e}^{Tau s} - Id Zc+Ud)]
```

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(%i9) A2zamena2: solve(jednacine[4], A2);
```

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(%o9) [A2=-{e}^{-2 Tau s} (Id Zc {e}^{Tau s} - A1)]
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```
(%i10) Alzamena2: solve([jednacine[1], jednacine[2]], [A1, A2]);
```

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(%o10) [[A1= \frac{I0 Zc+U0}{2}, A2= \frac{U0-I0 Zc}{2}]]
```

```
(%i11) Udjednacina: ev(jednacine[3],A2zamena2), A1zamena2;
```

```
(%o11) 
$$Ud = \frac{(I0 Zc + U0) e^{-Tau s}}{2} - e^{-Tau s} \left( Id Zc e^{Tau s} - \frac{I0 Zc + U0}{2} \right)$$

```

```
(%i12) Udzamena: zamena: solve(Udjednacina, Ud);
```

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(%o12) 
$$[Ud = -e^{-Tau s} (Id Zc e^{Tau s} - I0 Zc - U0)]$$

```

```
(%i13) zamenaIndeksa: [U0=U1, I0=I1, Ud=U2, Id=-I2];
```

```
(%o13) 
$$[U0=U1, I0=I1, Ud=U2, Id=-I2]$$

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```
(%i14) U1jednacina: [U1=ev(ev(U0, U0zamena), zamenaIndeksa)];
```

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(%o14) 
$$[U1 = e^{-Tau s} (I1 Zc e^{Tau s} + I2 Zc + U2)]$$

```

```
(%i15) U2jednacina: [U2=ev(ev(Ud, Udzamena), zamenaIndeksa)];
```

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(%o15) 
$$[U2 = -e^{-Tau s} (-I2 Zc e^{Tau s} - I1 Zc - U1)]$$

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(%i16) idealanVodLT: [U1jednacina[1], U2jednacina[1]], expand;
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(%o16) 
$$[U1 = I2 Zc e^{-Tau s} + U2 e^{-Tau s} + I1 Zc, U2 = I1 Zc e^{-Tau s} + U1 e^{-Tau s} + I2 Zc]$$

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(%i17) idealanVodLT_Yc: idealanVodLT, Zc=1/Yc, expand $;
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```
(%i18) vreneskiDomen: [I1.*e^(-s.Tau)=i1(t-Tau), I2.*e^(-s.Tau)=i2(t-Tau),  
U1.*e^(-s.Tau)=u1(t-Tau), U2.*e^(-s.Tau)=u2(t-Tau),  
U1=u1(t), I2=i2(t), I1=i1(t), U2=u2(t)];
```

```
(%o18) 
$$[I1 e^{-Tau s} = i1(t-Tau), I2 e^{-Tau s} = i2(t-Tau), U1 e^{-Tau s} = u1(t-Tau), U2 e^{-Tau s} = u2(t-Tau), U1 = u1(t), I2 = i2(t), I1 = i1(t), U2 = u2(t)]$$

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```
(%i19) idelniVodVD: idealanVodLT_Yc, vreneskiDomen, Yc=1/Zc;
```

```
(%o19) 
$$[u1(t) = u2(t-Tau) + Zc i2(t-Tau) + Zc i1(t), u2(t) = u1(t-Tau) + Zc i1(t-Tau) + Zc i2(t)]$$

```

```
(%i22) print("Braninove jednachine:")$;  
print(idelniVodVD[1])$;  
print(idelniVodVD[2])$;  
  
Braninove jednachine:  
u1 (t)=u2 (t-Tau)+Zc i2 (t-Tau)+Zc i1 (t)  
u2 (t)=u1 (t-Tau)+Zc i1 (t-Tau)+Zc i2 (t)
```