

Ingenieurbüro Baumann --- www.leobaumann.de --- Markt 6, 46282 Dorsten

Impedanz eines Dipols über der Länge bis zu $4 \cdot \lambda$

d =Drahtdurchmesser, h :=Antennenlänge, ZF_0 - Feldwellenwiderstand Vakuum, ϵ_r - Permittivität, μ_r - Permeabilität

- `reset():digits:=16:d:=1/1000:lambda:=1:ZF0:=120*PI:ur:=1:er:=1:`

Mindestverhältnis l/λ für d , $l_{\min}=25 \cdot d$

- `kmin:=float(25*d/lambda);`

0.025

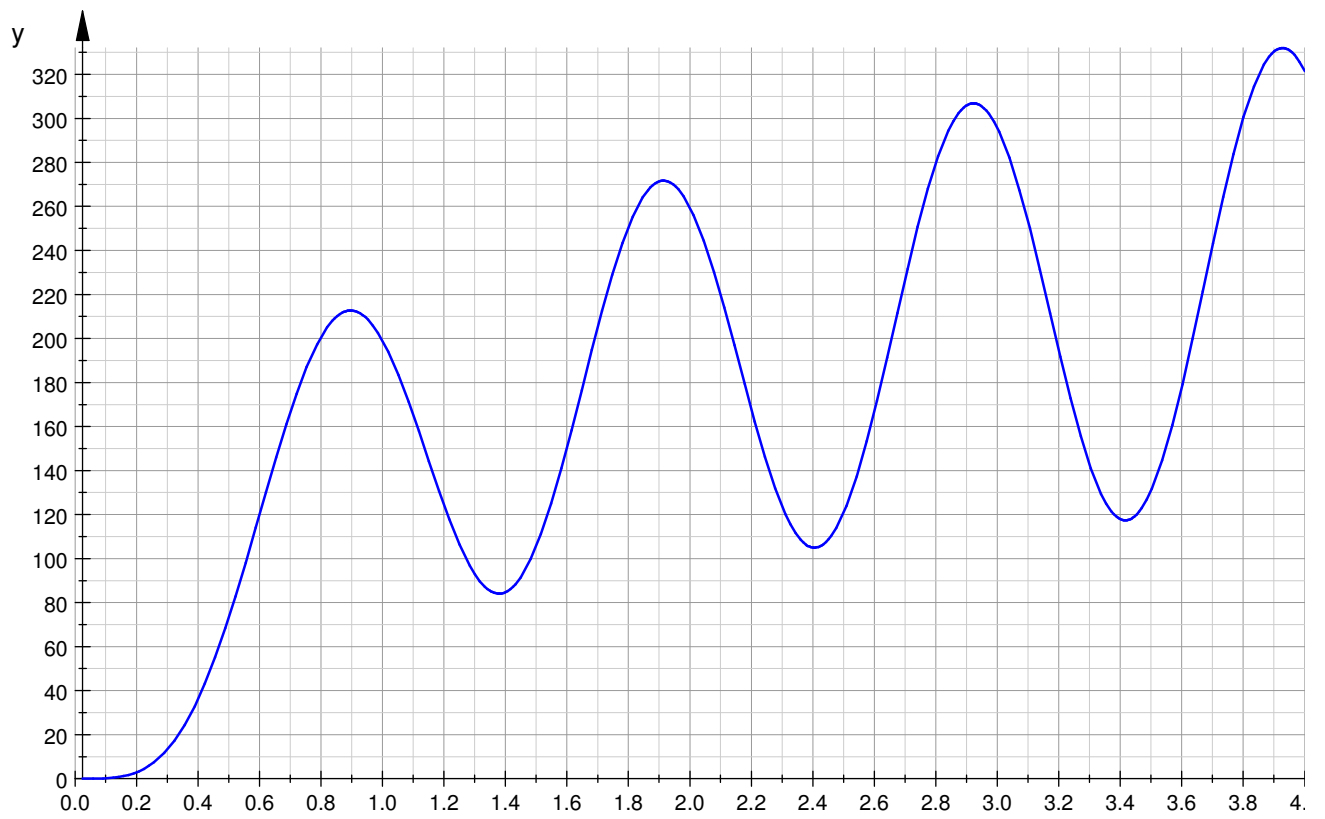
BALANIS-Funktionen (Gleichung 4.70 u. 4.70a, Band III)

- `Z_Re:=(k)->ZF0/(2*PI)*sqrt(ur/er)*(EULER+ln(2*PI*k)-
Ci(2*PI*k)+1/2*sin(2*PI*k)*(Si(4*PI*k)-
2*Si(2*PI*k))+1/2*cos(2*PI*k)*(EULER+ln(PI*k)+Ci(4*PI*k)-
2*Ci(2*PI*k))):`
- `Z_Im:=(k)-
>ZF0/(4*PI)*sqrt(ur/er)*(2*Si(2*PI*k)+cos(2*PI*k)*(2*Si(2*PI*k)-
Si(4*PI*k))-sin(2*PI*k)*(2*Ci(2*PI*k)-Ci(4*PI*k)-
Ci(2*2*PI*d^2/4/k*(ur*er)/lambda^2))):`

Resistanz über l/λ

- `plotfunc2d(Z_Re(m), m=kmin..4, GridVisible=TRUE,
SubgridVisible=TRUE, AdaptiveMesh=4, Height=120*unit::mm,
Width=180*unit::mm, Header="Resistanz"):`

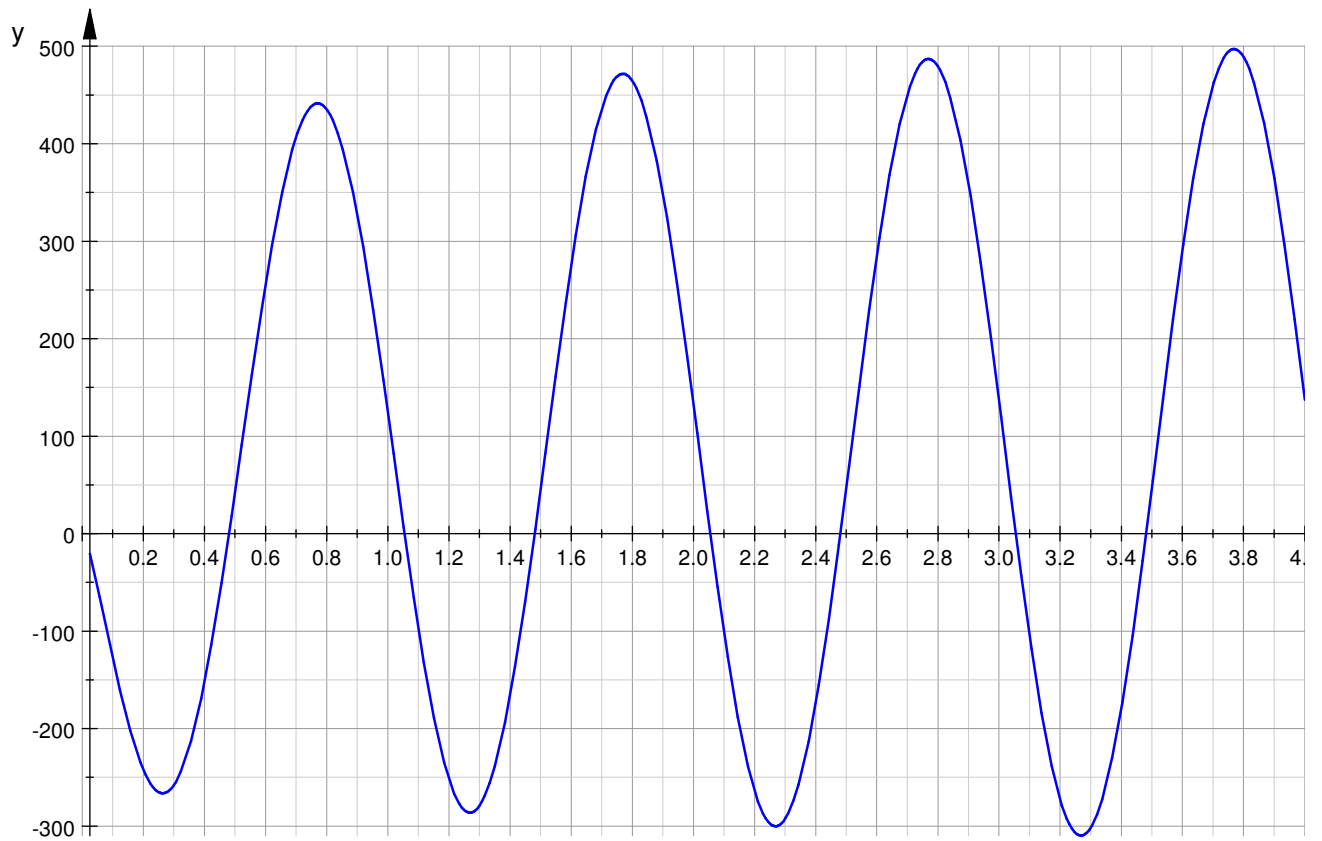
Resistanz



Reaktanz Antennenimpedanz über l/Lambda

- `plotfunc2d(Z_Im(m), m=kmin..4, GridVisible=TRUE, SubgridVisible=TRUE, AdaptiveMesh=4, Height=120*unit::mm, Width=180*unit::mm, Header="Reaktanz"):`

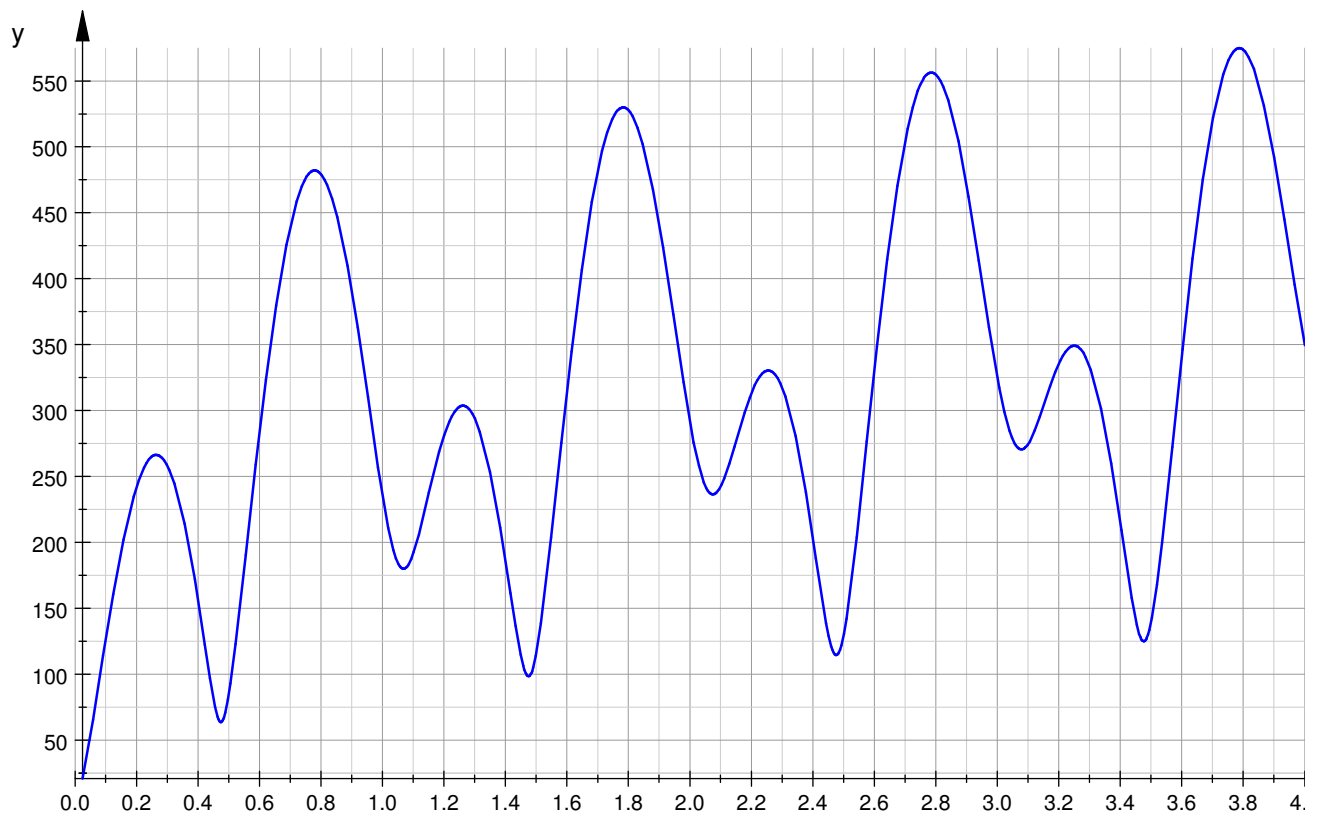
Reaktanz



Betrag der Antennenimpedanz über l/Lambda

- `plotfunc2d(sqrt(Z_Re(m)^2+Z_Im(m)^2), m=kmin..4, GridVisible=TRUE, SubgridVisible=TRUE, AdaptiveMesh=4, Height=120*unit::mm, Width=180*unit::mm, Header="Betrag Impedanz"):`

Betrag Impedanz



l/Lambda für $Z_{Re} = 50$ Ohm

- `h:=op(numeric::solve(Z_Re(m)=50, m=kmin..0.6, RestrictedSearch),1);`
0.4418125766

zugehöriger Reaktanz

- `float(Z_Im(h));`
-78.34851969

genaue Resonanzlänge für $l/\text{Lambda}=1/2$

- `numeric::solve(Z_Im(m)=0, m=kmin..1/2, RestrictedSearch);`
{0.480269069}

genaue Resonanzlänge für $l/\text{Lambda}=1$

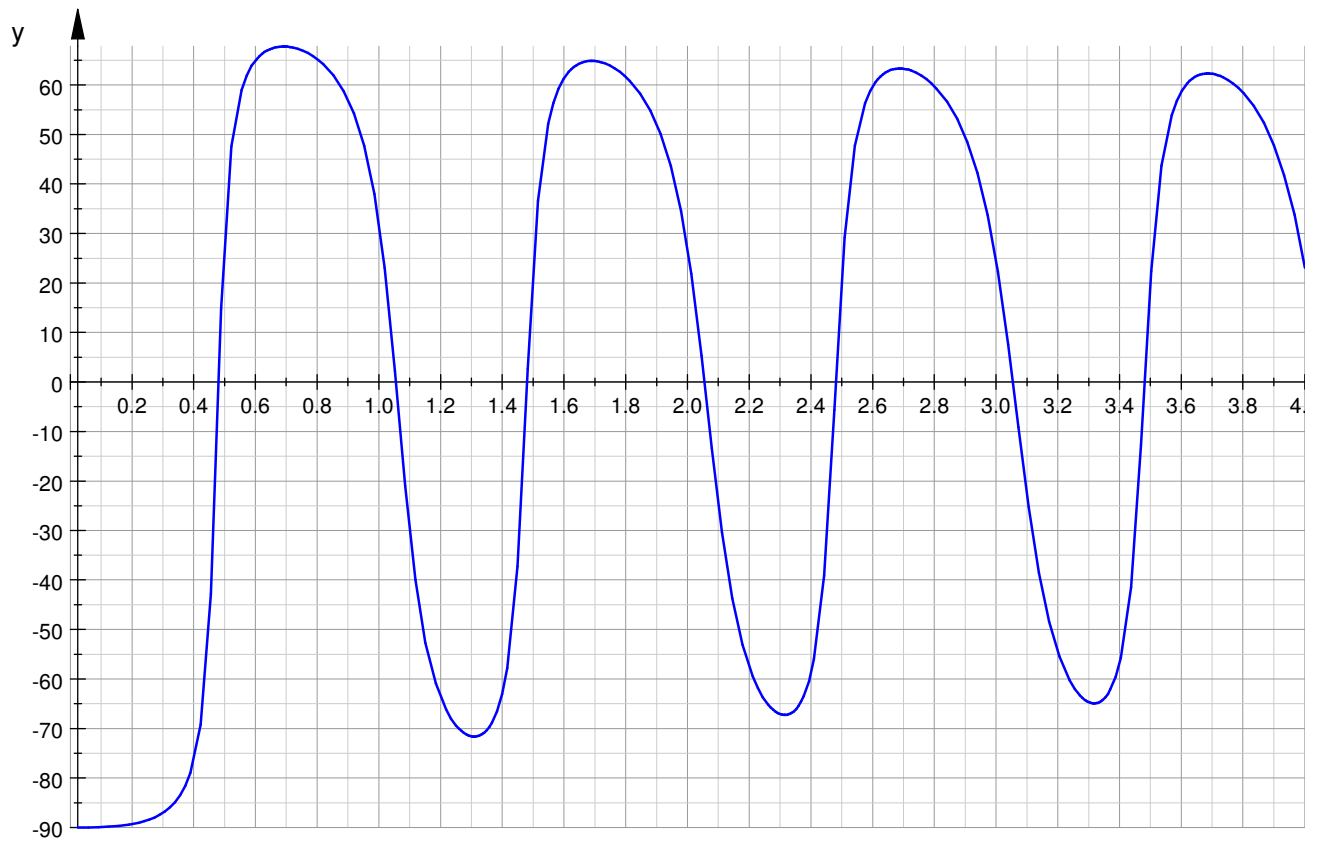
- `numeric::solve(Z_Im(m)=0, m=1/2..1.1, RestrictedSearch);`
{1.054991257}

Winkel der Antennenimpedanz über l/Lambda

- `plotfunc2d(180/PI*arctan(Z_Im(m)/Z_Re(m)), m=25*d/lambda..4,`

```
GridVisible=TRUE, SubgridVisible=TRUE, AdaptiveMesh=4,
Height=120*unit::mm, Width=180*unit::mm, Header="Winkel Impedanz"):
```

Winkel Impedanz



einige Dipolimpedanzen für die Liste h/Lambda

- `m:=[i/2 $ i=1..20];`

$$\left[\frac{1}{2}, 1, \frac{3}{2}, 2, \frac{5}{2}, 3, \frac{7}{2}, 4, \frac{9}{2}, 5, \frac{11}{2}, 6, \frac{13}{2}, 7, \frac{15}{2}, 8, \frac{17}{2}, 9, \frac{19}{2}, 10 \right]$$

- `for i from 1 to 20 do`
`Z[i]:=[op(m,i), float(Z_Re(op(m,i))+I*Z_Im(op(m,i)))]:`
`end_for:`
- `Z;`

$$\begin{aligned} 1 &= \left[\frac{1}{2}, 73.12960179 + 42.54454728 \cdot i\right] \\ 2 &= [1, 199.0877106 + 125.4133524 \cdot i] \\ 3 &= \left[\frac{3}{2}, 105.4942314 + 45.54101884 \cdot i\right] \\ 4 &= [2, 259.6341168 + 133.1254085 \cdot i] \\ 5 &= \left[\frac{5}{2}, 120.7661345 + 46.17087239 \cdot i\right] \\ 6 &= [3, 295.7503387 + 135.8348497 \cdot i] \\ 7 &= \left[\frac{7}{2}, 130.8455471 + 46.44249809 \cdot i\right] \\ 8 &= [4, 321.5068037 + 137.2082252 \cdot i] \\ 9 &= \left[\frac{9}{2}, 138.3788851 + 46.59370815 \cdot i\right] \\ 10 &= [5, 341.5256327 + 138.0378209 \cdot i] \\ 11 &= \left[\frac{11}{2}, 144.3959125 + 46.69001215 \cdot i\right] \\ 12 &= [6, 357.9010938 + 138.5907605 \cdot i] \\ 13 &= \left[\frac{13}{2}, 149.4057551 + 46.75671907 \cdot i\right] \\ 14 &= [7, 371.7538126 + 138.9870608 \cdot i] \\ 15 &= \left[\frac{15}{2}, 153.6976631 + 46.80565149 \cdot i\right] \\ 16 &= [8, 383.7580849 + 139.2845827 \cdot i] \\ 17 &= \left[\frac{17}{2}, 157.4518103 + 46.84307732 \cdot i\right] \\ 18 &= [9, 394.3492613 + 139.5161596 \cdot i] \\ 19 &= \left[\frac{19}{2}, 160.7880554 + 46.87262776 \cdot i\right] \\ 20 &= [10, 403.8289717 + 139.697487 \cdot i] \end{aligned}$$

