Ingenieurbüro Baumann --- www.leobaumann.de --- Markt 6, 46282 Dorsten
Impedanz eines Dipols über der Länge bis zu 4 * Lambda
d=Drahtdurchmesser, h:=Antennenlänge, ZF0 - Feldwellenwiderstabd Vakuum, ur - Permittivität, er - Permeabilität

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

Mindestverhältnis l/Lambda für d, lmin=25*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))):
```

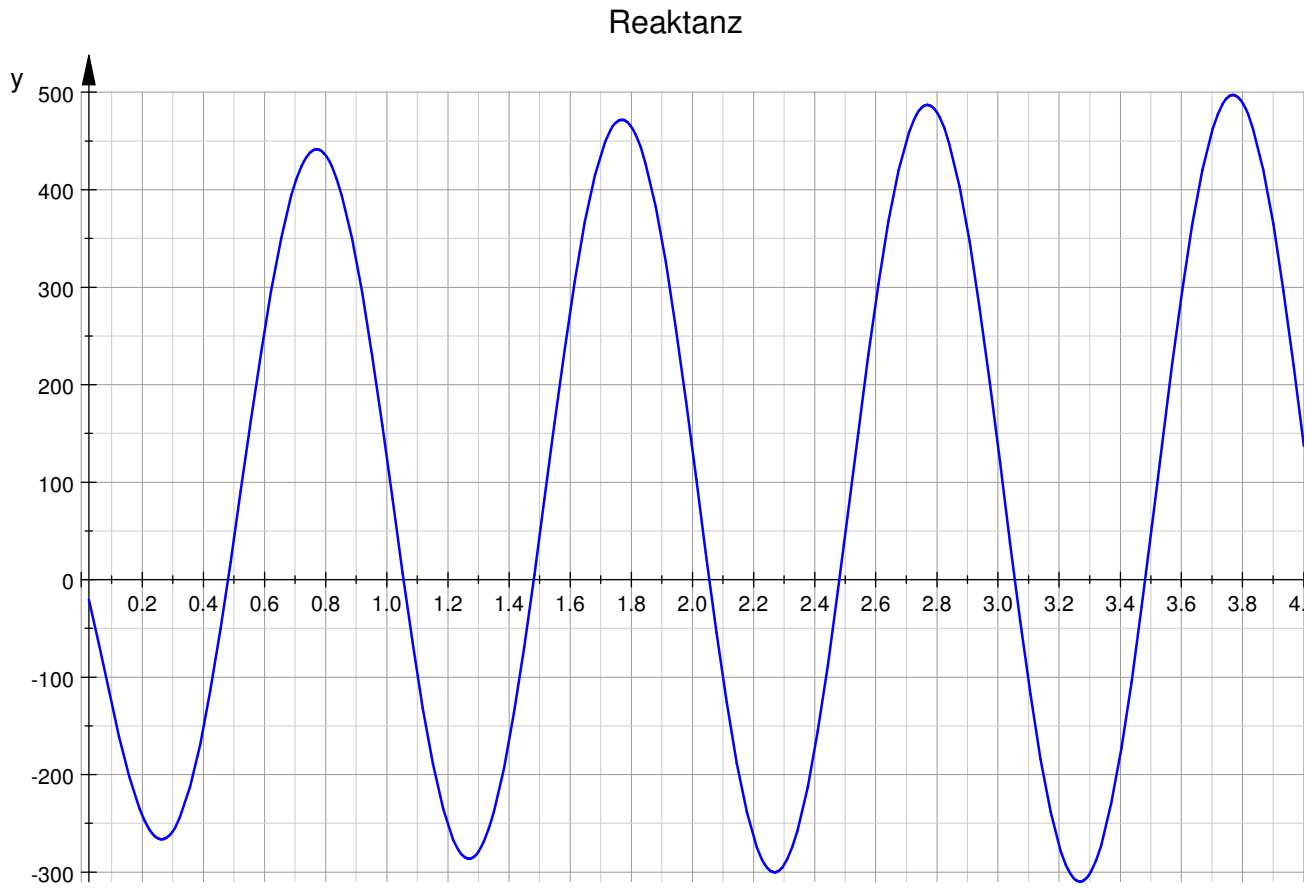
```
Z_Im:=(k)-
>ZF0/(4*PI)*sqrt(ur/er)*(2*Si(2*PI*k)+cos(2*PI*k)*(2*Si(2*PI*k)-
Si(4*PI*k))-sin(2*PI*k)*(2*Ci(2*PI*k)-Ci(4*PI*k)-
Ci(2*2*PI*d^2/4/k*(ur*er)/lambda^2))):
```

Resistanz über l/Lambda

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

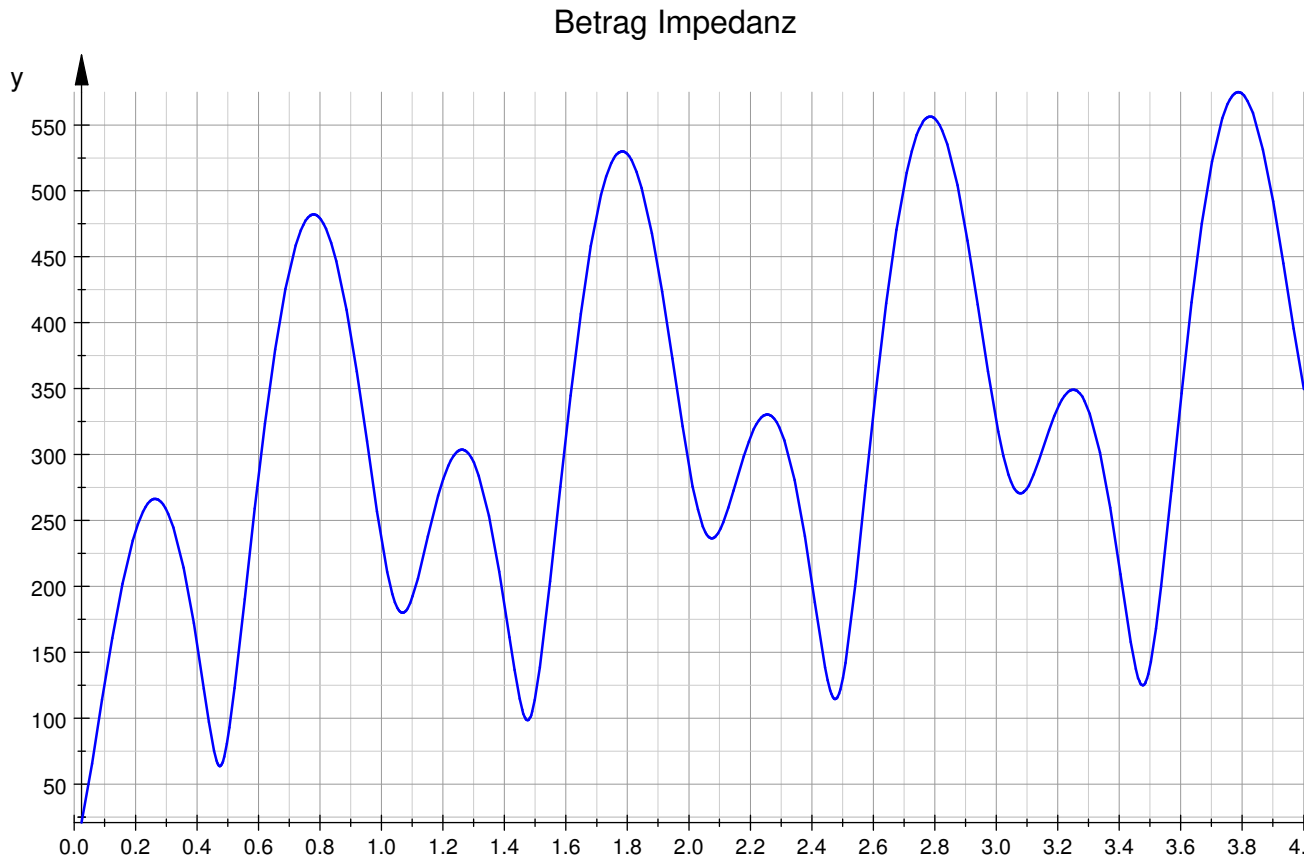
Reaktanz Antennenimpedanz über l/Lambda

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



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"):`



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/Lambda=1/2

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

  {0.480269069}

genaue Resonanzlänge für l/Lambda=1

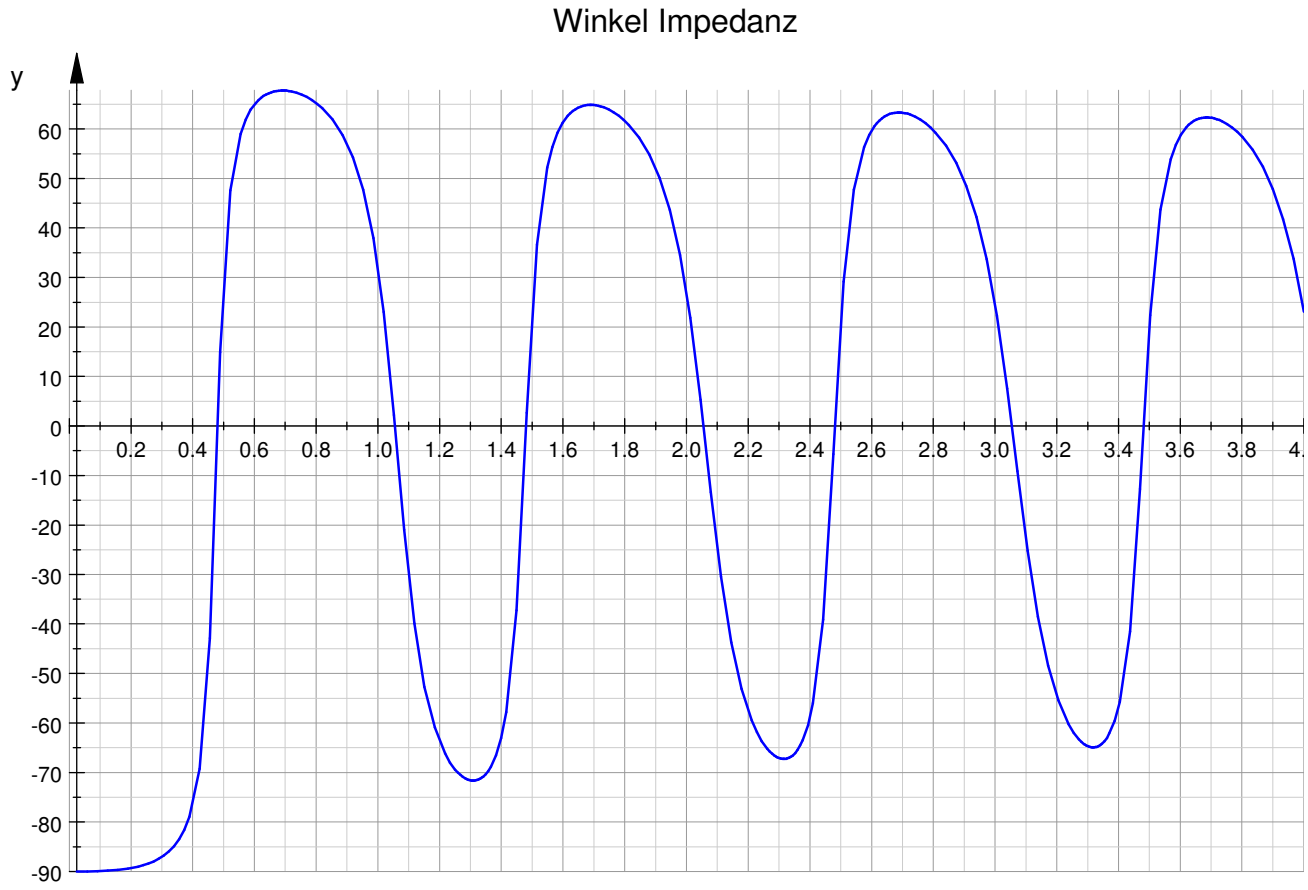
- `numeric::solve(Z_Im(m)=0, m=1/2..1.1, RestrictedSearch);`

  {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"):
```



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;`
  ```

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