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, er - Permittivität, ur - Permeabilität

```
reset():digits:=16:d:=1/1000:lambda:=1:ZF0:=376.73031366757:ur:=1:er:=1:
```

Mindestverhältnis l/Lambda für d, lmin=25*d

```
kmin:=float(10*d/lambda);
```

0.01

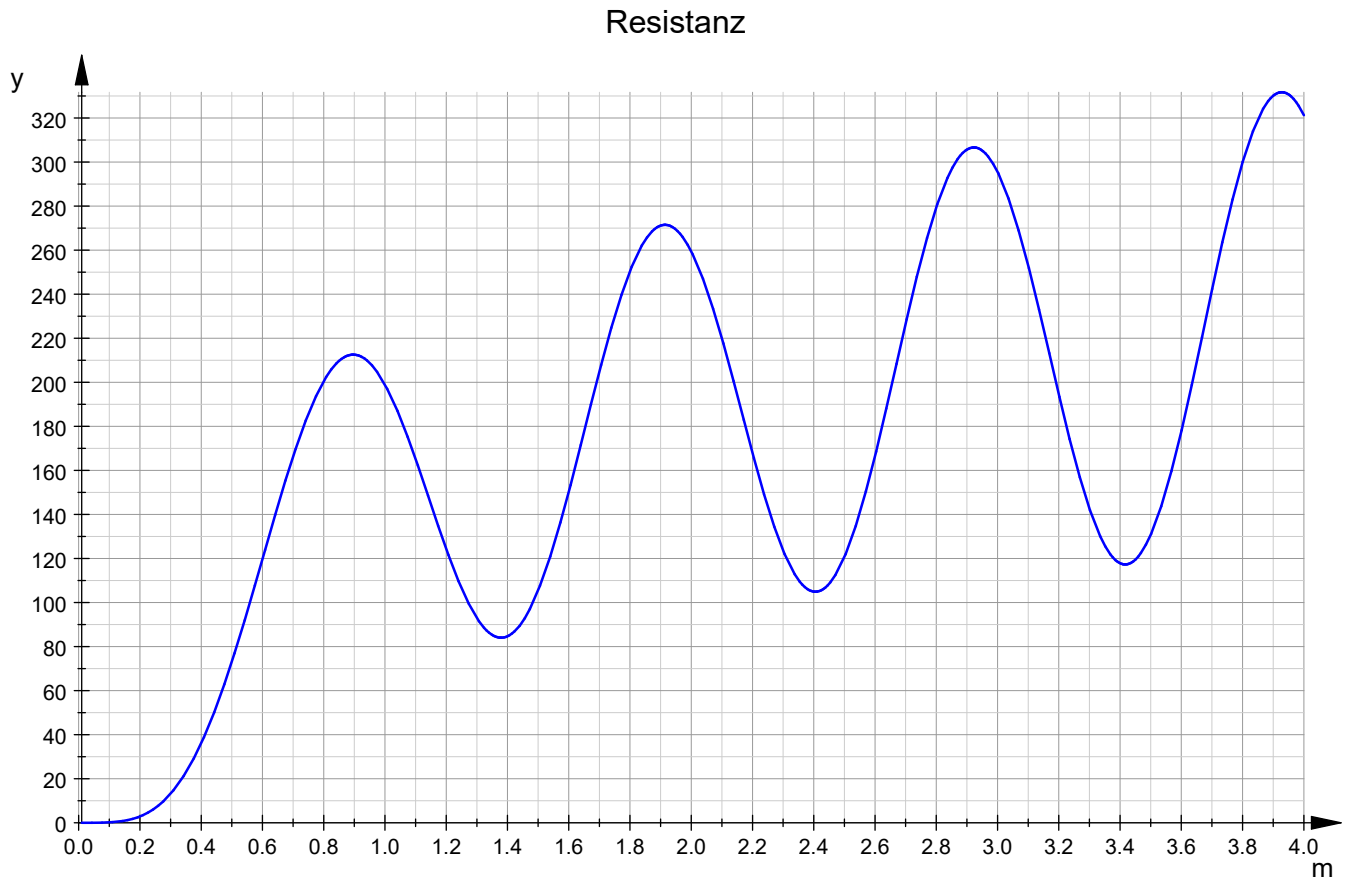
BALANIS-Funktionen (Gleichung 4.70 u. 4.70a, Band IV)

```
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/lambda^2))):
```

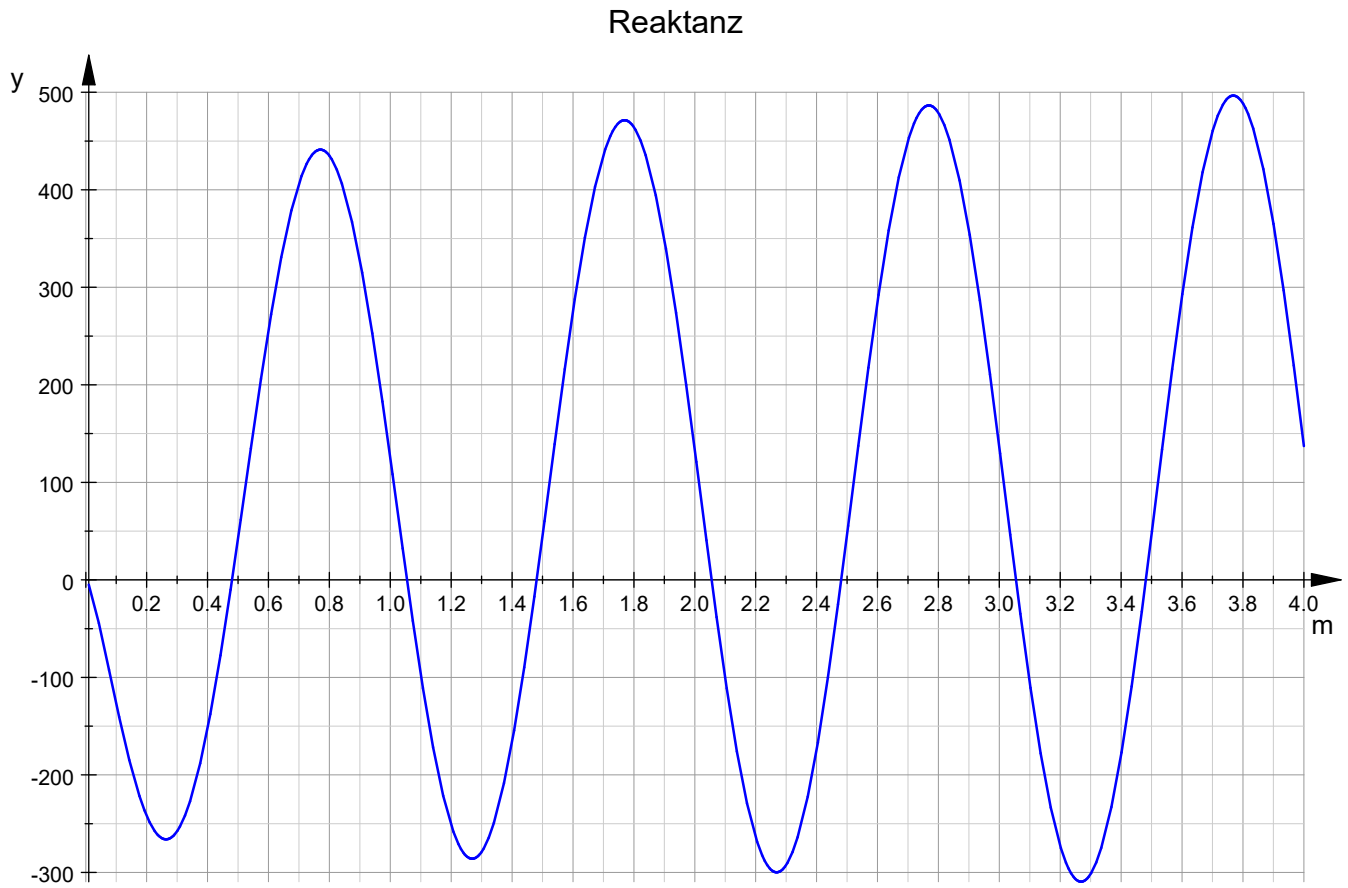
Resistanz über l/Lambda

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



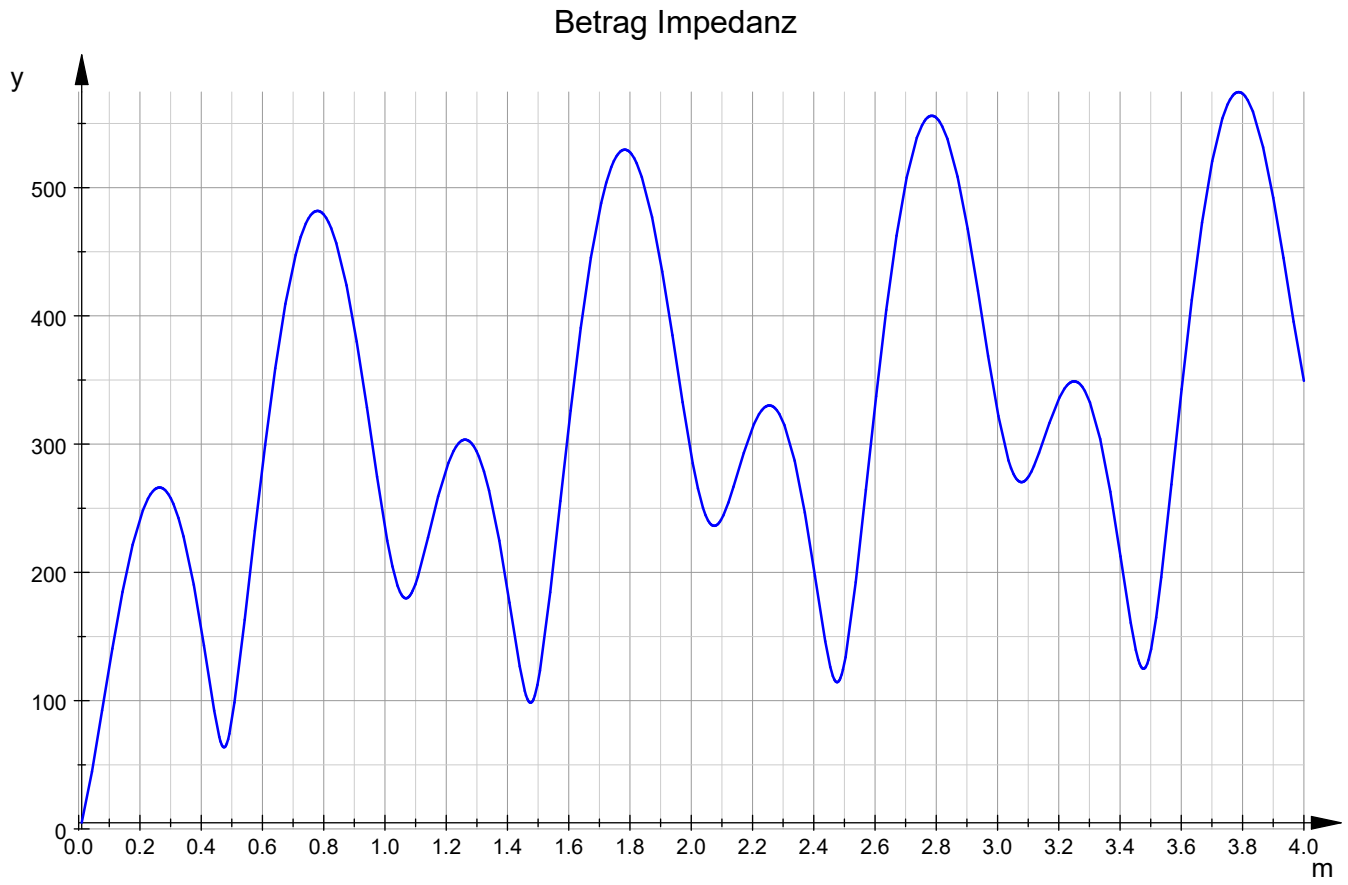
Reaktanz Antennenimpedanz über l/Lambda

- `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);`

  0.4419084661

zugehöriger Reaktanz

- `float(Z_Im(h));`

  – 78.10940211

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

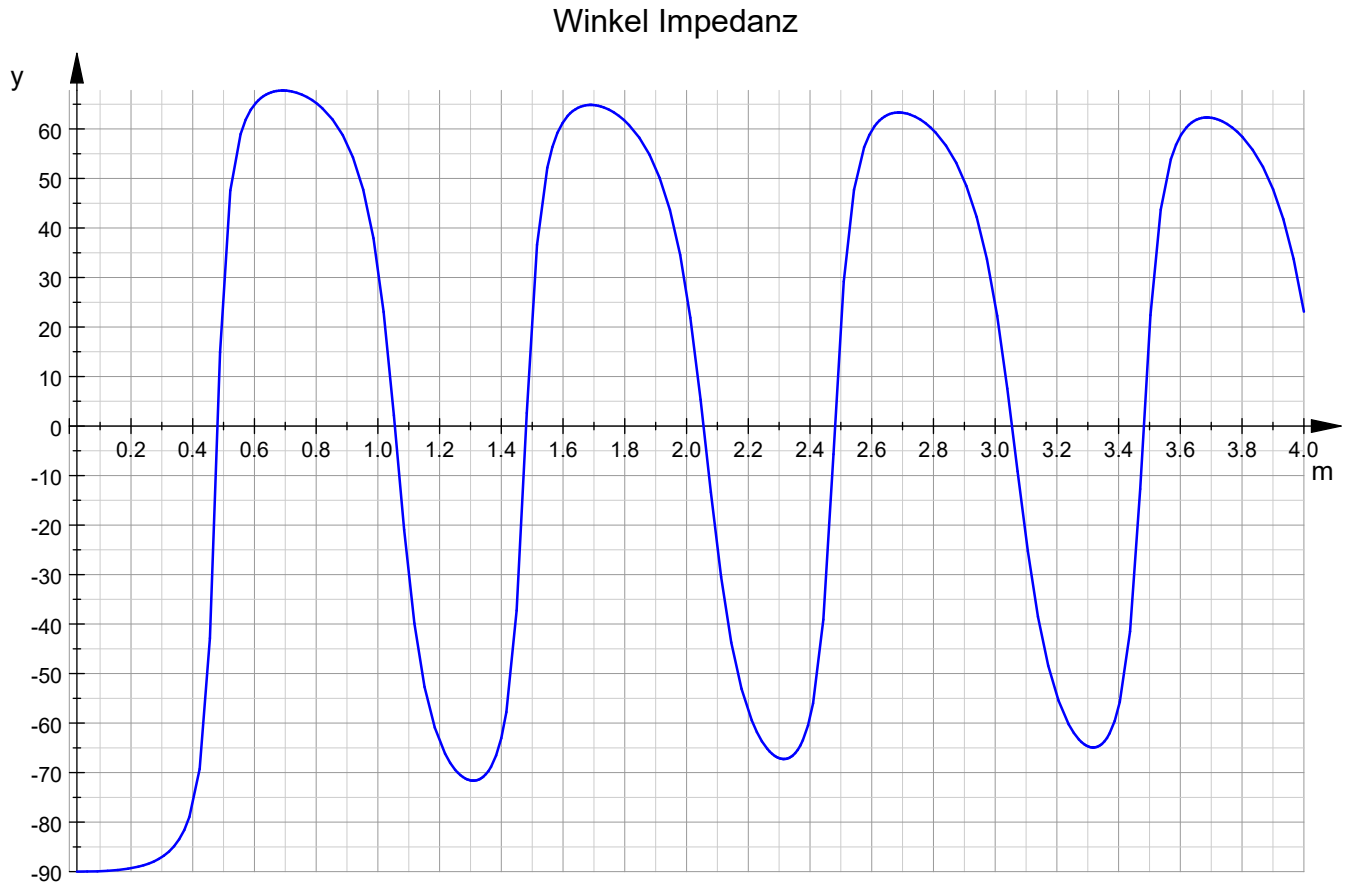
- `numeric::solve(Z_Im(m)=0, m=1/2..1.1, RestrictedSearch);`

  {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;`
  ```

$$
\begin{aligned}
1 &= [\tfrac{1}{2},\ 73.07901029 + 42.51511471 \cdot i] \\
2 &= [1,\ 198.9499805 + 125.3265906 \cdot i] \\
3 &= [\tfrac{3}{2},\ 105.4212498 + 45.50951329 \cdot i] \\
4 &= [2,\ 259.4545003 + 133.0333115 \cdot i] \\
5 &= [\tfrac{5}{2},\ 120.6825877 + 46.1389311 \cdot i] \\
6 &= [3,\ 295.5457368 + 135.7408783 \cdot i] \\
7 &= [\tfrac{7}{2},\ 130.7550274 + 46.41036889 \cdot i] \\
8 &= [4,\ 321.2843833 + 137.1133037 \cdot i] \\
9 &= [\tfrac{9}{2},\ 138.2831537 + 46.56147434 \cdot i] \\
10 &= [5,\ 341.2893632 + 137.9423255 \cdot i] \\
11 &= [\tfrac{11}{2},\ 144.2960185 + 46.65771171 \cdot i] \\
12 &= [6,\ 357.6534956 + 138.4948826 \cdot i] \\
13 &= [\tfrac{13}{2},\ 149.3023953 + 46.72437248 \cdot i] \\
14 &= [7,\ 371.4966311 + 138.8909088 \cdot i] \\
15 &= [\tfrac{15}{2},\ 153.5913341 + 46.77327106 \cdot i] \\
16 &= [8,\ 383.4925987 + 139.1882248 \cdot i] \\
17 &= [\tfrac{17}{2},\ 157.3428842 + 46.81067099 \cdot i] \\
18 &= [9,\ 394.0764481 + 139.4196415 \cdot i] \\
19 &= [\tfrac{19}{2},\ 160.6768213 + 46.84020099 \cdot i] \\
20 &= [10,\ 403.5496004 + 139.6008434 \cdot i]
\end{aligned}
$$