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

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Impedanz verschiedener Dipole des Durchmessers d, ungeradzahliger Vielfacher von Lambda/2 im freien Raum, sinusförmige Stromverteilung

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

BALANIS-Funktionen

```
Z_Re:=(k)->ZF0*sqrt(ur/er)/(2*PI)*(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*sqrt(ur/er)/(4*PI)*(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))):
```

```
m:=[(2*i-1)/2 $ i=1..10];
```

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

```
for i from 1 to 10 do
Z[i]:=[op(m,i),float(Z_Re(op(m,i))+I*Z_Im(op(m,i)))]:
end_for:
```

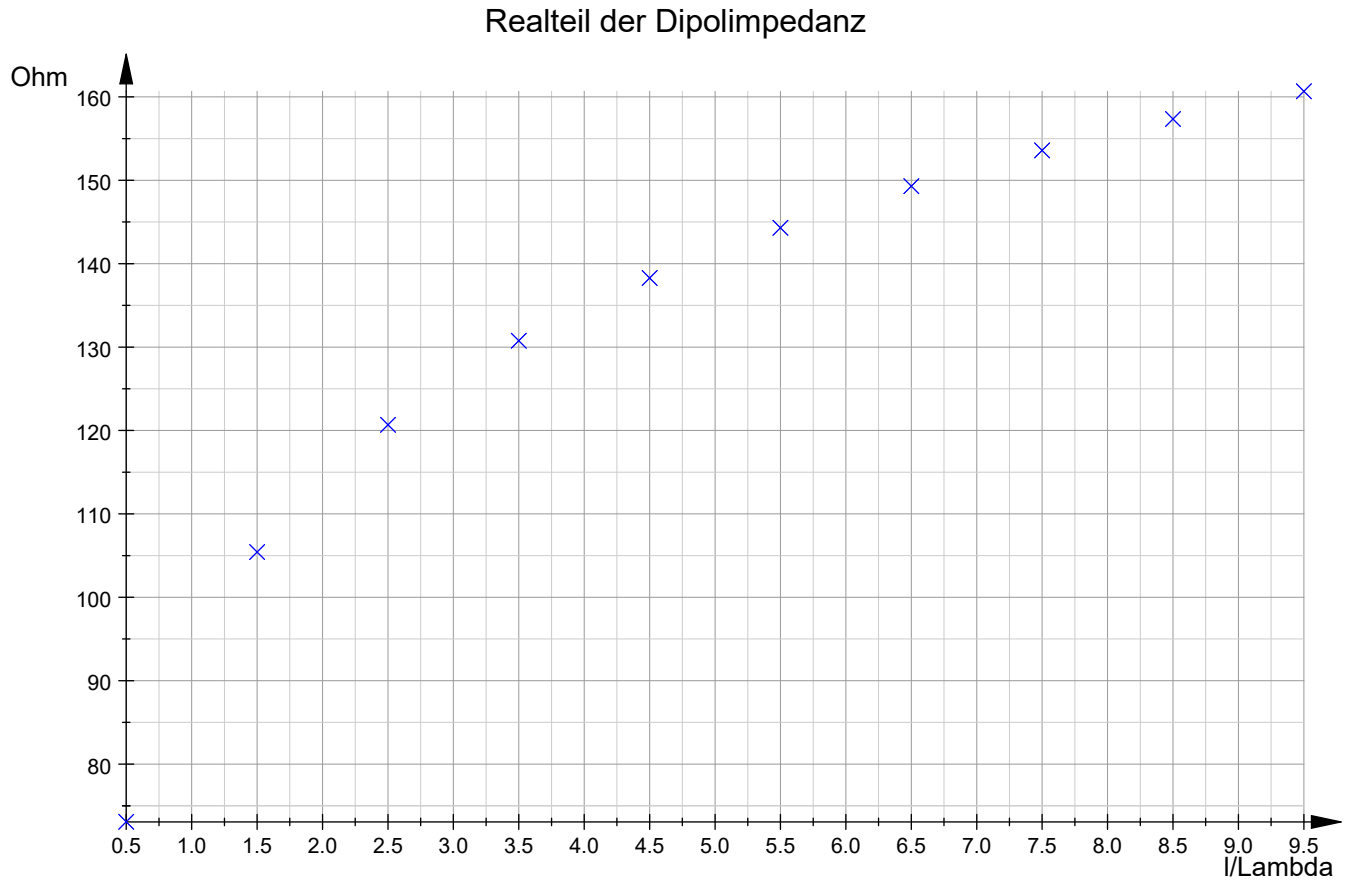
Dipol-Impedanzen für l/Lambda laut Liste m

```
Z;
```

$$\begin{bmatrix} 1 & = \left[\frac{1}{2}, 73.07901029 + 42.51511471 \cdot i\right] \\ 2 & = \left[\frac{3}{2}, 105.4212498 + 45.50951329 \cdot i\right] \\ 3 & = \left[\frac{5}{2}, 120.6825877 + 46.1389311 \cdot i\right] \\ 4 & = \left[\frac{7}{2}, 130.7550274 + 46.41036889 \cdot i\right] \\ 5 & = \left[\frac{9}{2}, 138.2831537 + 46.56147434 \cdot i\right] \\ 6 & = \left[\frac{11}{2}, 144.2960185 + 46.65771171 \cdot i\right] \\ 7 & = \left[\frac{13}{2}, 149.3023953 + 46.72437248 \cdot i\right] \\ 8 & = \left[\frac{15}{2}, 153.5913341 + 46.77327106 \cdot i\right] \\ 9 & = \left[\frac{17}{2}, 157.3428842 + 46.81067099 \cdot i\right] \\ 10 & = \left[\frac{19}{2}, 160.6768213 + 46.84020099 \cdot i\right] \end{bmatrix}$$

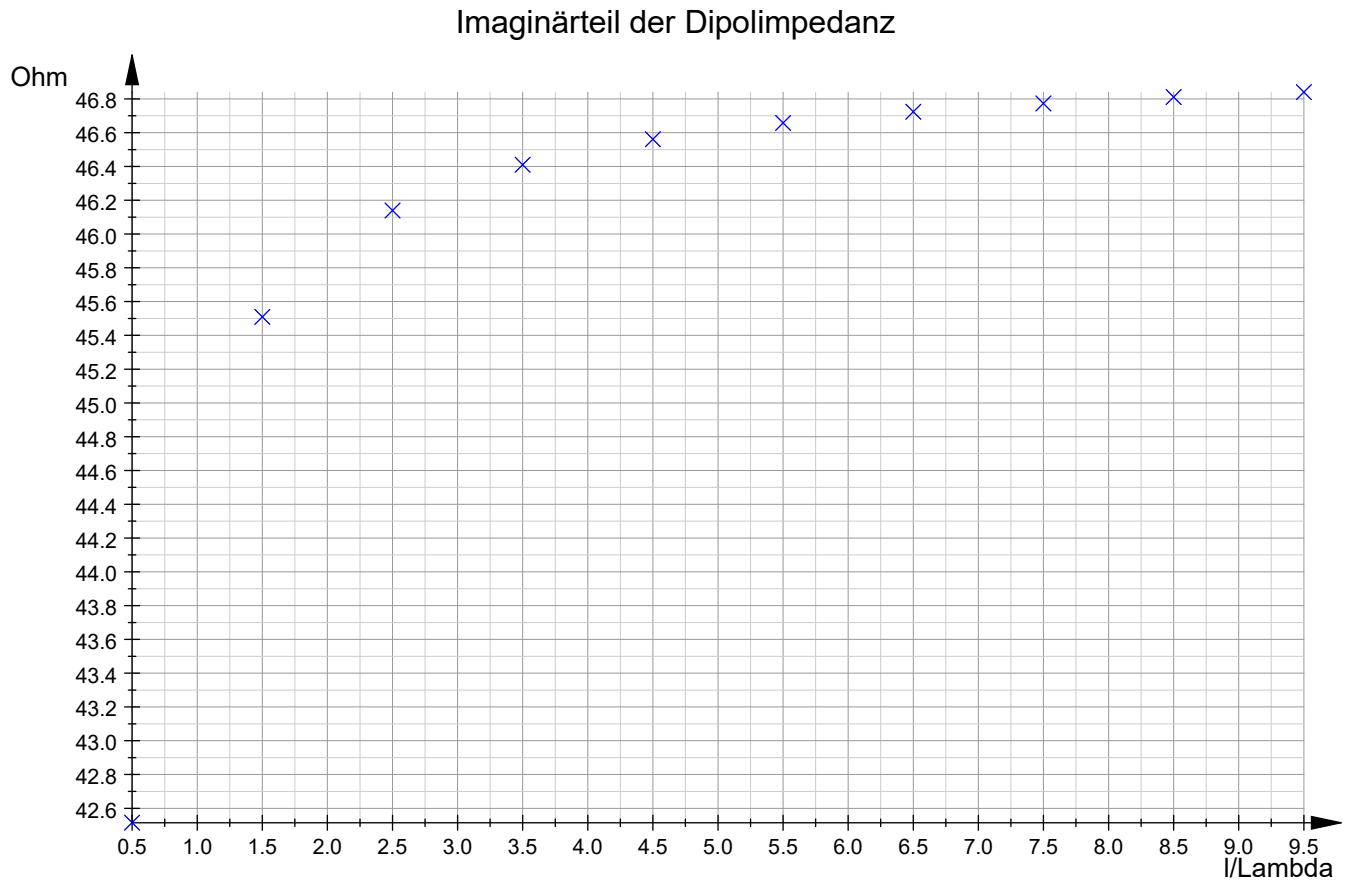
```
Liste:=[[op(Z[i],1),Re(op(Z[i],2)),RGB::Blue] $ i=1..10]:
plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2,
```

```
Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,
                          Scaling=Unconstrained,
  AxesTitles=["l/Lambda","Ohm"]), Height=120*unit::mm,
  Width=180*unit::mm, Header="Realteil der Dipolimpedanz"):
```




- ```
  Liste:=[[op(Z[i],1),Im(op(Z[i],2)),RGB::Blue] $ i=1..10]:
  ```

- ```
  plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2,
  Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,
                          Scaling=Unconstrained,
    AxesTitles=["l/Lambda","Ohm"]), Height=120*unit::mm,
    Width=180*unit::mm, Header="Imaginärteil der Dipolimpedanz"):
  ```



Impedanz verschiedener Dipole des Durchmessers d, geradzahliger Vielfacher von Lambda/2 im freien Raum, sinusförmige Stromverteilung

---

- `m:=[i $ i=1..10];`

  [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

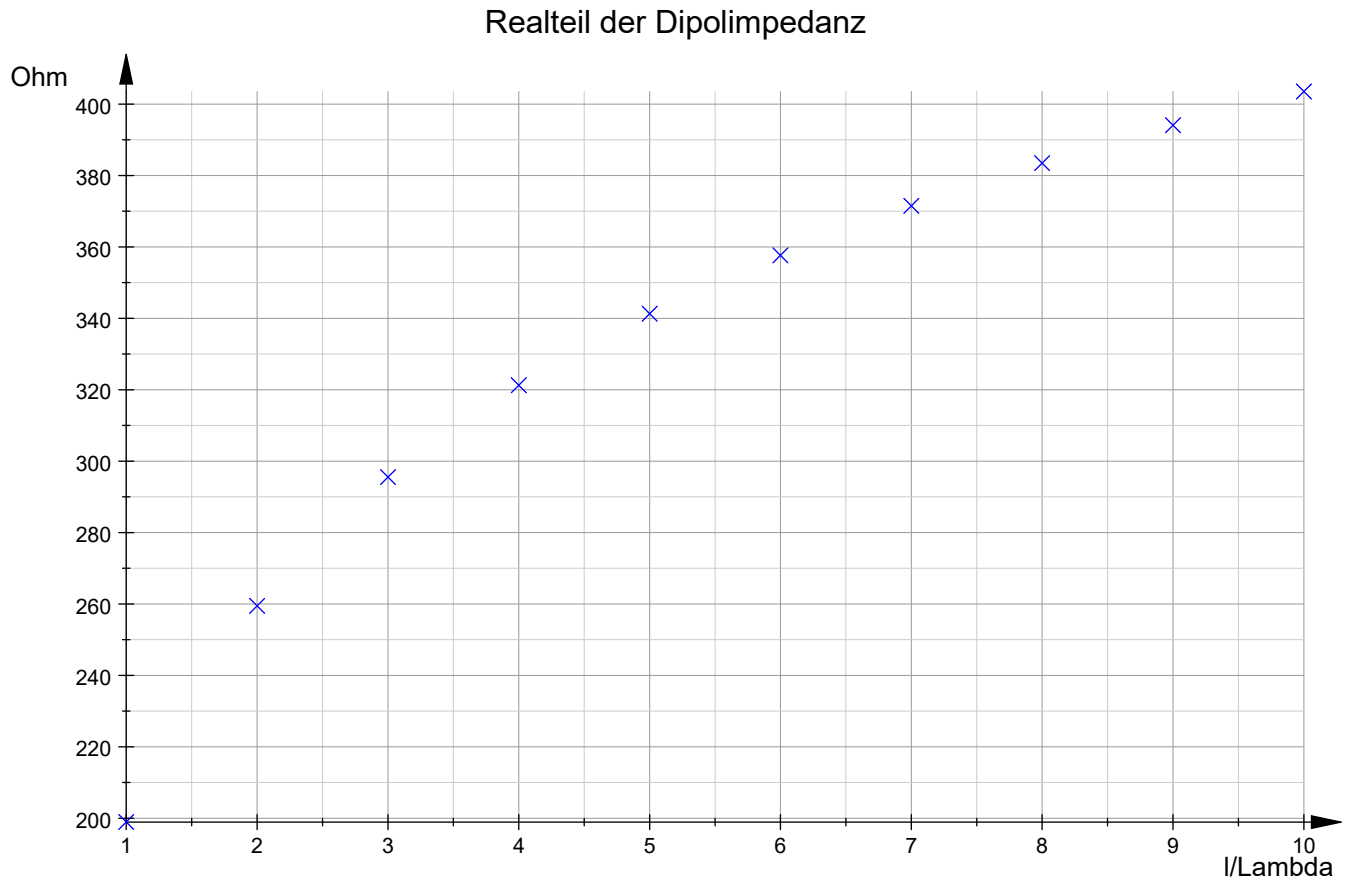
- ```
  for i from 1 to 10 do
  Z[i]:=[op(m,i),float(Z_Re(op(m,i))+I*Z_Im(op(m,i)))]:
  end_for:
  ```

Dipol-Impedanzen für l/Lambda laut Liste m

- `Z;`
  ```

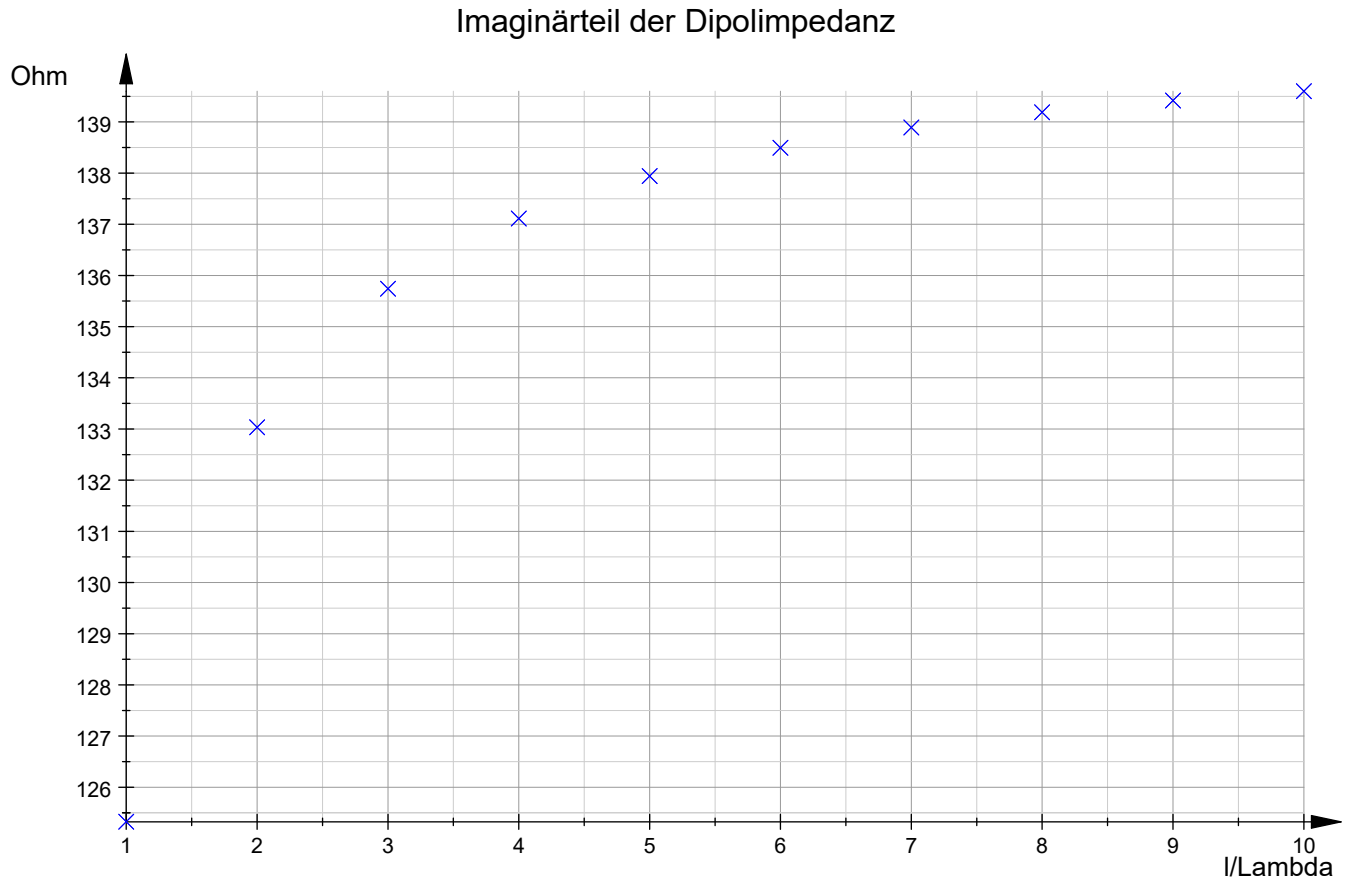
$$
\begin{bmatrix}
1 & = [1,\ 198.9499805 + 125.3265906 \cdot i] \\
2 & = [2,\ 259.4545003 + 133.0333115 \cdot i] \\
3 & = [3,\ 295.5457368 + 135.7408783 \cdot i] \\
4 & = [4,\ 321.2843833 + 137.1133037 \cdot i] \\
5 & = [5,\ 341.2893632 + 137.9423255 \cdot i] \\
6 & = [6,\ 357.6534956 + 138.4948826 \cdot i] \\
7 & = [7,\ 371.4966311 + 138.8909088 \cdot i] \\
8 & = [8,\ 383.4925987 + 139.1882248 \cdot i] \\
9 & = [9,\ 394.0764481 + 139.4196415 \cdot i] \\
10 & = [10,\ 403.5496004 + 139.6008434 \cdot i]
\end{bmatrix}
$$

- `Liste:=[[op(Z[i],1),Re(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- ```
  plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2,
  Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,
                         Scaling=Unconstrained,
    AxesTitles=["l/Lambda","Ohm"]), Height=120*unit::mm,
    Width=180*unit::mm, Header="Realteil der Dipolimpedanz"):
  ```



- `Liste:=[[op(Z[i],1),Im(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- ```
  plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2,
  Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,
  ```

```
                    Scaling=Unconstrained,
AxesTitles=["l/Lambda","Ohm"]), Height=120*unit::mm,
Width=180*unit::mm, Header="Imaginärteil der Dipolimpedanz"):
```



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