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

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Impedanz verschiedener Dipole des Durchmessers d, ungeradzahliger Vielfacher von Lambda/2 in Seewasser, sinusförmige Stromverteilung

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```
reset():digits:=16:d:=1/1000:ZF0:=376.73031366757:ur:=0.999991:er:=81: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:
```

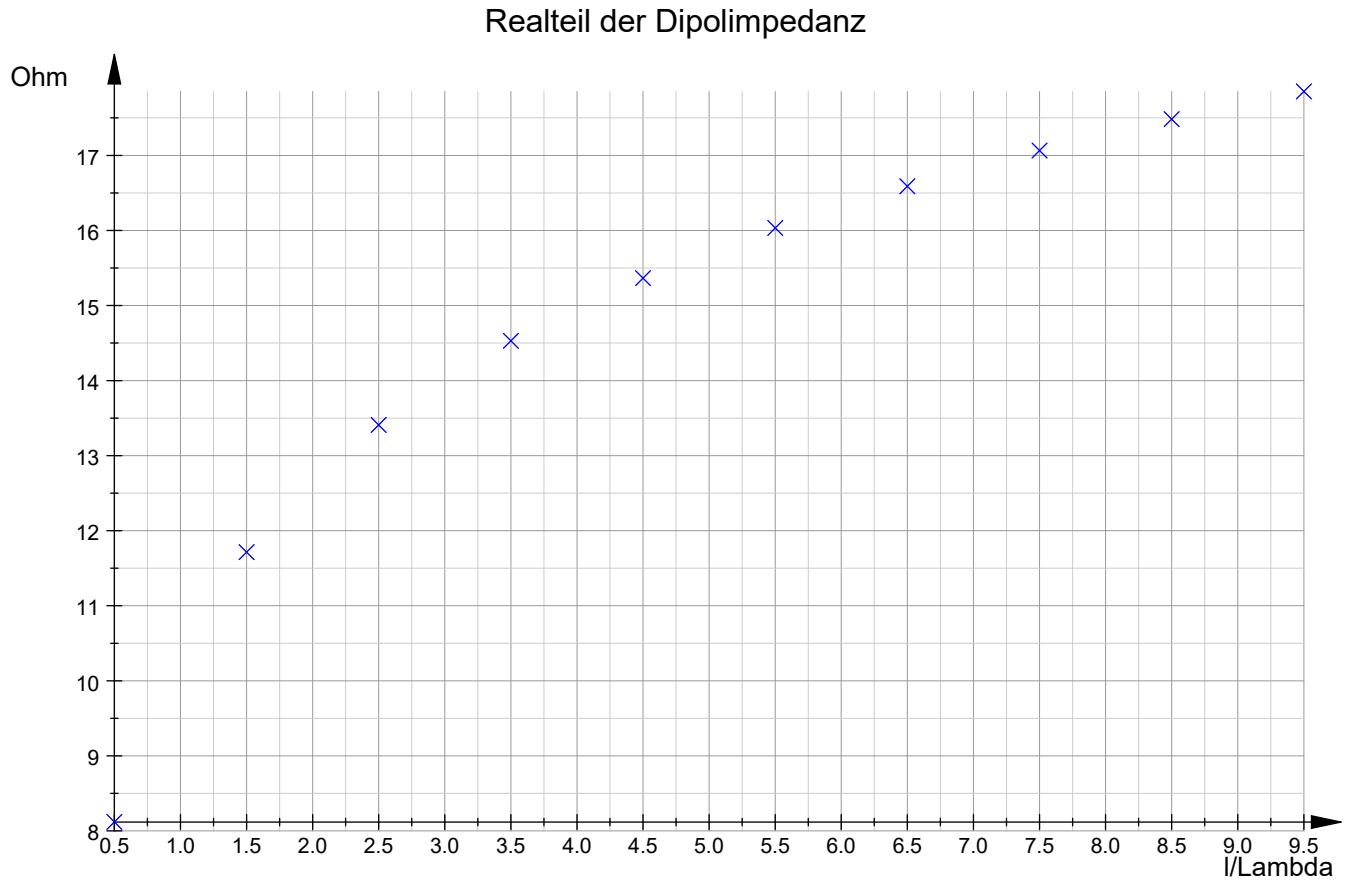
Dipol-Impedanzen für l/Lambda laut Liste m

```
Z;
```

$$\begin{bmatrix} 1 & = [\frac{1}{2}, 8.119853492 + 4.723880376 \cdot i] \\ 2 & = [\frac{3}{2}, 11.71341949 + 5.056589833 \cdot i] \\ 3 & = [\frac{5}{2}, 13.40911607 + 5.12652483 \cdot i] \\ 4 & = [\frac{7}{2}, 14.528271 + 5.156684449 \cdot i] \\ 5 & = [\frac{9}{2}, 15.36472571 + 5.173473868 \cdot i] \\ 6 & = [\frac{11}{2}, 16.0328188 + 5.184166861 \cdot i] \\ 7 & = [\frac{13}{2}, 16.58908038 + 5.19157358 \cdot i] \\ 8 & = [\frac{15}{2}, 17.06562699 + 5.197006731 \cdot i] \\ 9 & = [\frac{17}{2}, 17.48246402 + 5.201162261 \cdot i] \\ 10 & = [\frac{19}{2}, 17.8528998 + 5.204443357 \cdot i] \end{bmatrix}$$

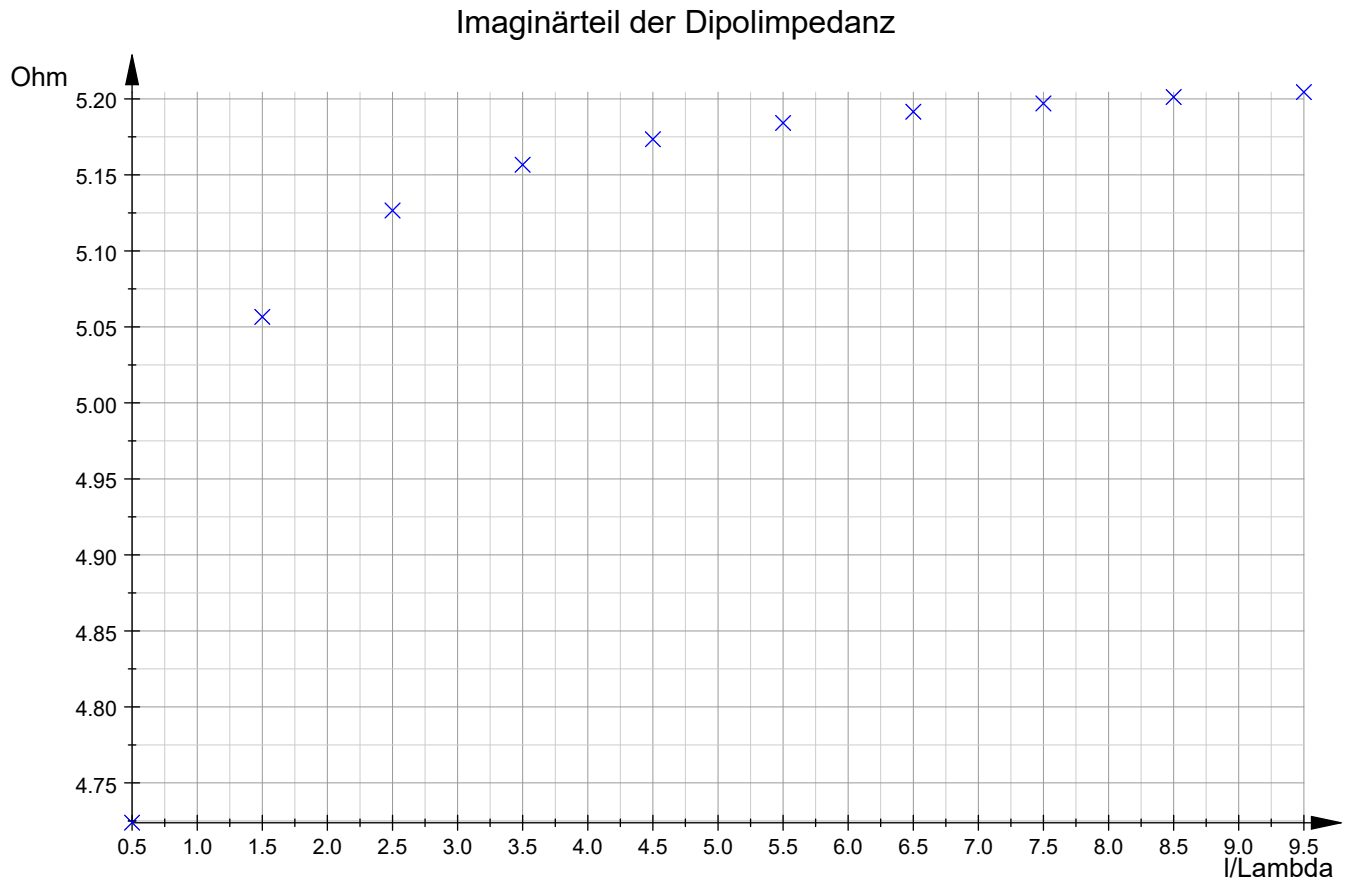
```
Liste:=[[op(Z[i],1),Re(op(Z[i],2)),RGB::Blue] $ i=1..10]:
plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2,
```

```
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"):
  ```



Impedanz verschiedener Dipole des Durchmessers d, geradzahliger Vielfacher von Lambda/2 in Seewasser, sinusförmige Stromverteilung

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- `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;`
  ```

$$
\begin{bmatrix}
1 & = [1,\ 22.10545392 + 13.92511407 \cdot i] \\
2 & = [2,\ 28.82814808 + 14.78141254 \cdot i] \\
3 & = [3,\ 32.83826743 + 15.08225194 \cdot i] \\
4 & = [4,\ 35.69810417 + 15.23474297 \cdot i] \\
5 & = [5,\ 37.92086971 + 15.32685608 \cdot i] \\
6 & = [6,\ 39.73909846 + 15.38825104 \cdot i] \\
7 & = [7,\ 41.27721771 + 15.43225375 \cdot i] \\
8 & = [8,\ 42.610097 + 15.46528871 \cdot i] \\
9 & = [9,\ 43.78607497 + 15.49100157 \cdot i] \\
10 & = [10,\ 44.83864271 + 15.51113502 \cdot i]
\end{bmatrix}
$$

```
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,
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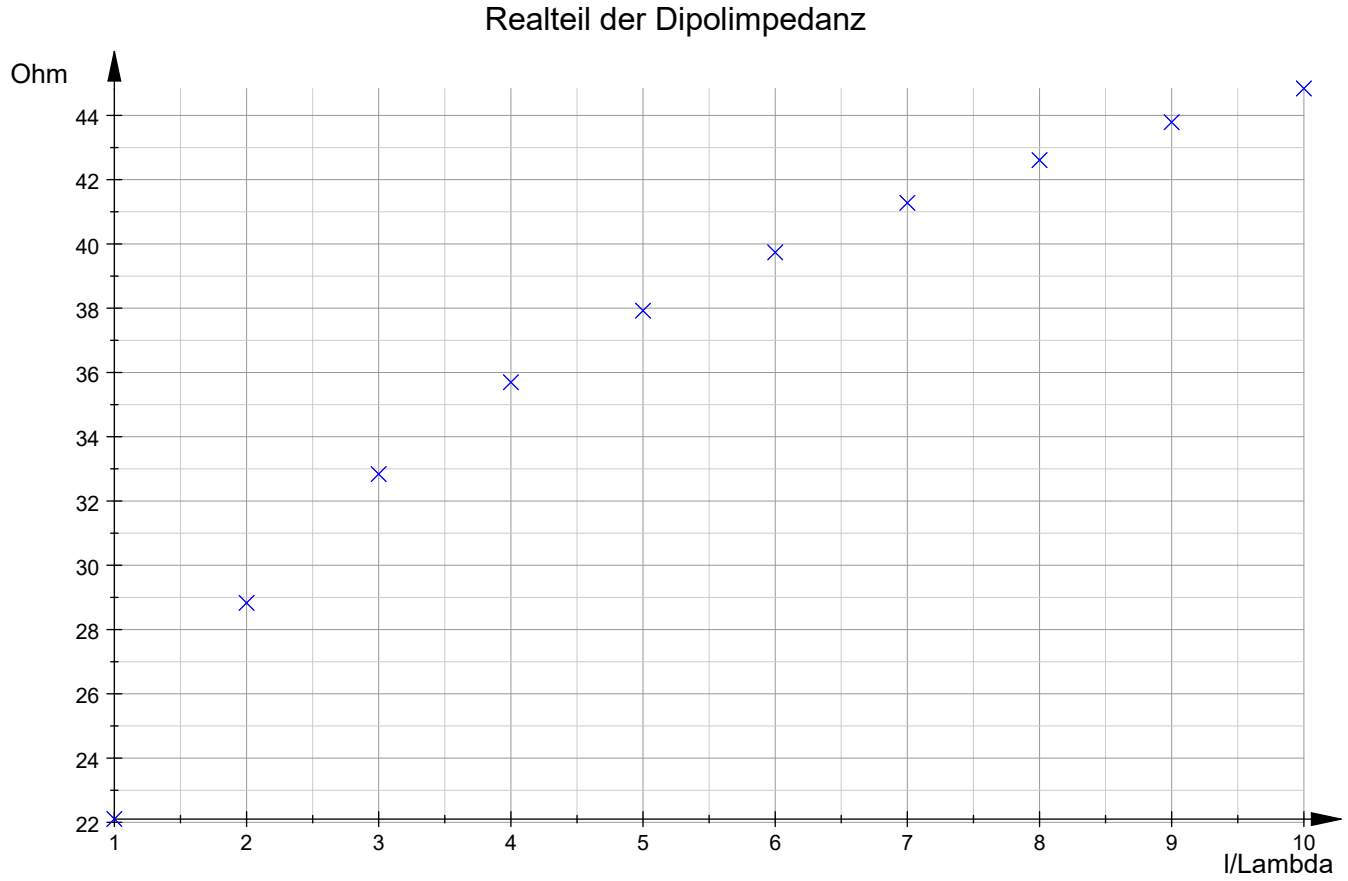
```

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```
                    Scaling=Unconstrained,
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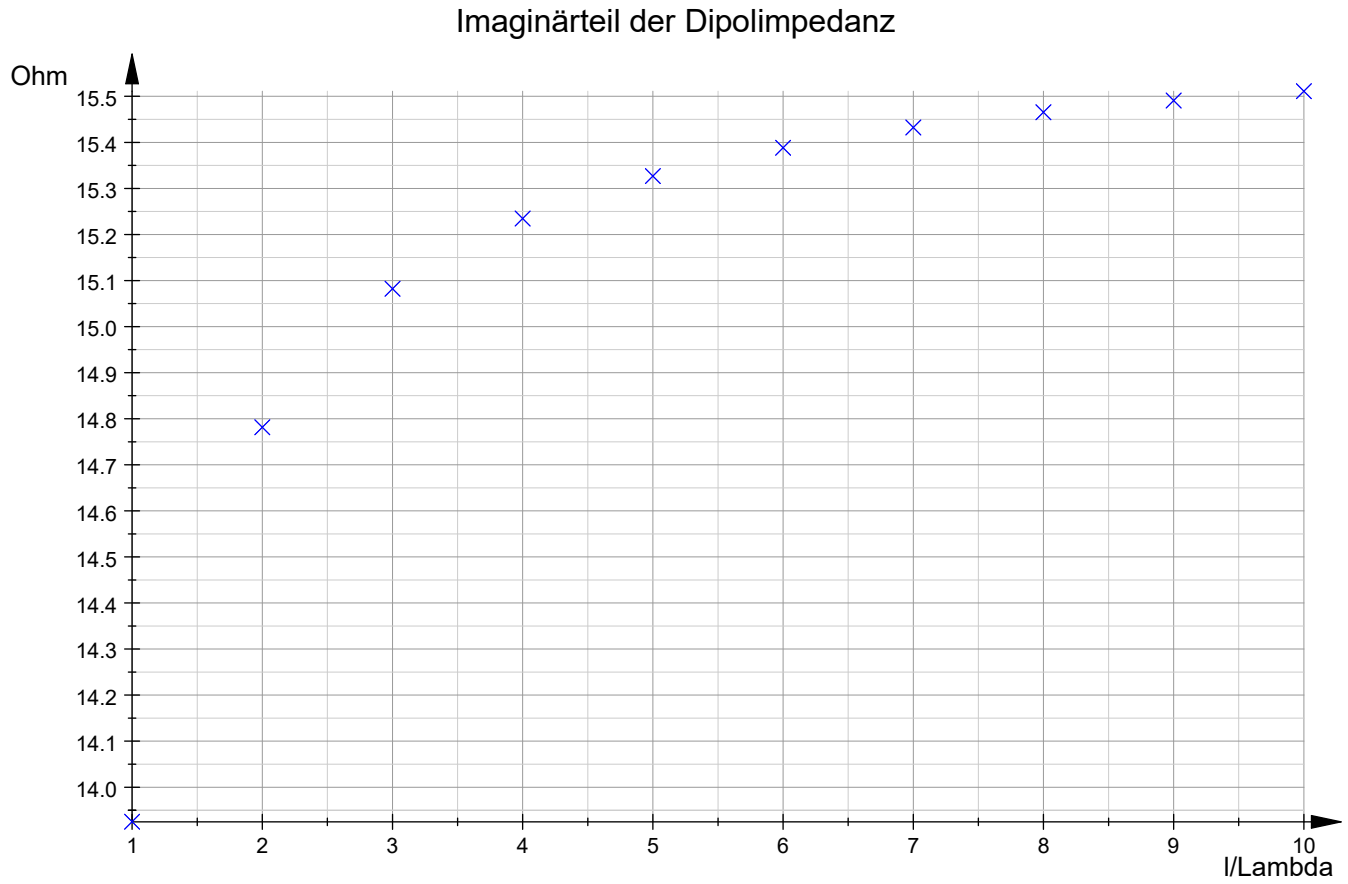
```



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