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Impedanz verschiedener Dipole des Durchmessers d, ungeradzahligter 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

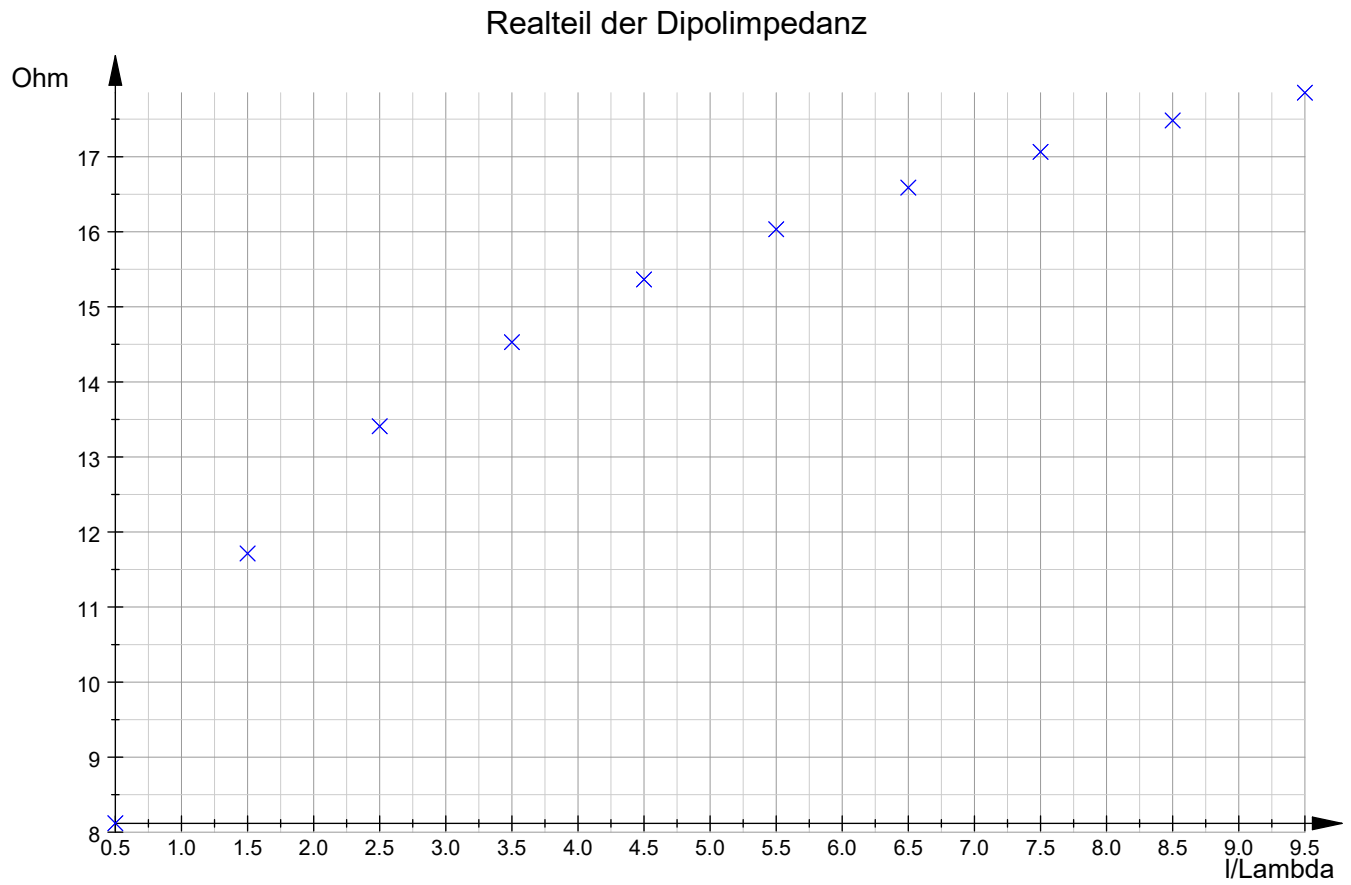
- `Z_Re:=(k)->ZF0*sqrt(ur/er)/(2*PI)*(EULER+ln(2*PI*k)-Ci(2*PI*k)+1/2*sin(2*PI*k)*(Si(4*PI*k)-2*Si(2*PI*k))+1/2*cos(2*PI*k)*(EULER+ln(PI*k)+Ci(4*PI*k)-2*Ci(2*PI*k))):`
- `Z_Im:=(k)->ZF0*sqrt(ur/er)/(4*PI)*(2*Si(2*PI*k)+cos(2*PI*k)*(2*Si(2*PI*k)-Si(4*PI*k))-sin(2*PI*k)*(2*Ci(2*PI*k)-Ci(4*PI*k)-Ci(2*2*PI*d^2/4/k/lambda^2))):`
- `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;`  
$$\left[ \begin{array}{l} 1 = \left[ \frac{1}{2}, 8.119853492 + 4.723880376 \cdot i \right] \\ 2 = \left[ \frac{3}{2}, 11.71341949 + 5.056589833 \cdot i \right] \\ 3 = \left[ \frac{5}{2}, 13.40911607 + 5.12652483 \cdot i \right] \\ 4 = \left[ \frac{7}{2}, 14.528271 + 5.156684449 \cdot i \right] \\ 5 = \left[ \frac{9}{2}, 15.36472571 + 5.173473868 \cdot i \right] \\ 6 = \left[ \frac{11}{2}, 16.0328188 + 5.184166861 \cdot i \right] \\ 7 = \left[ \frac{13}{2}, 16.58908038 + 5.19157358 \cdot i \right] \\ 8 = \left[ \frac{15}{2}, 17.06562699 + 5.197006731 \cdot i \right] \\ 9 = \left[ \frac{17}{2}, 17.48246402 + 5.201162261 \cdot i \right] \\ 10 = \left[ \frac{19}{2}, 17.8528998 + 5.204443357 \cdot i \right] \end{array} \right.$$

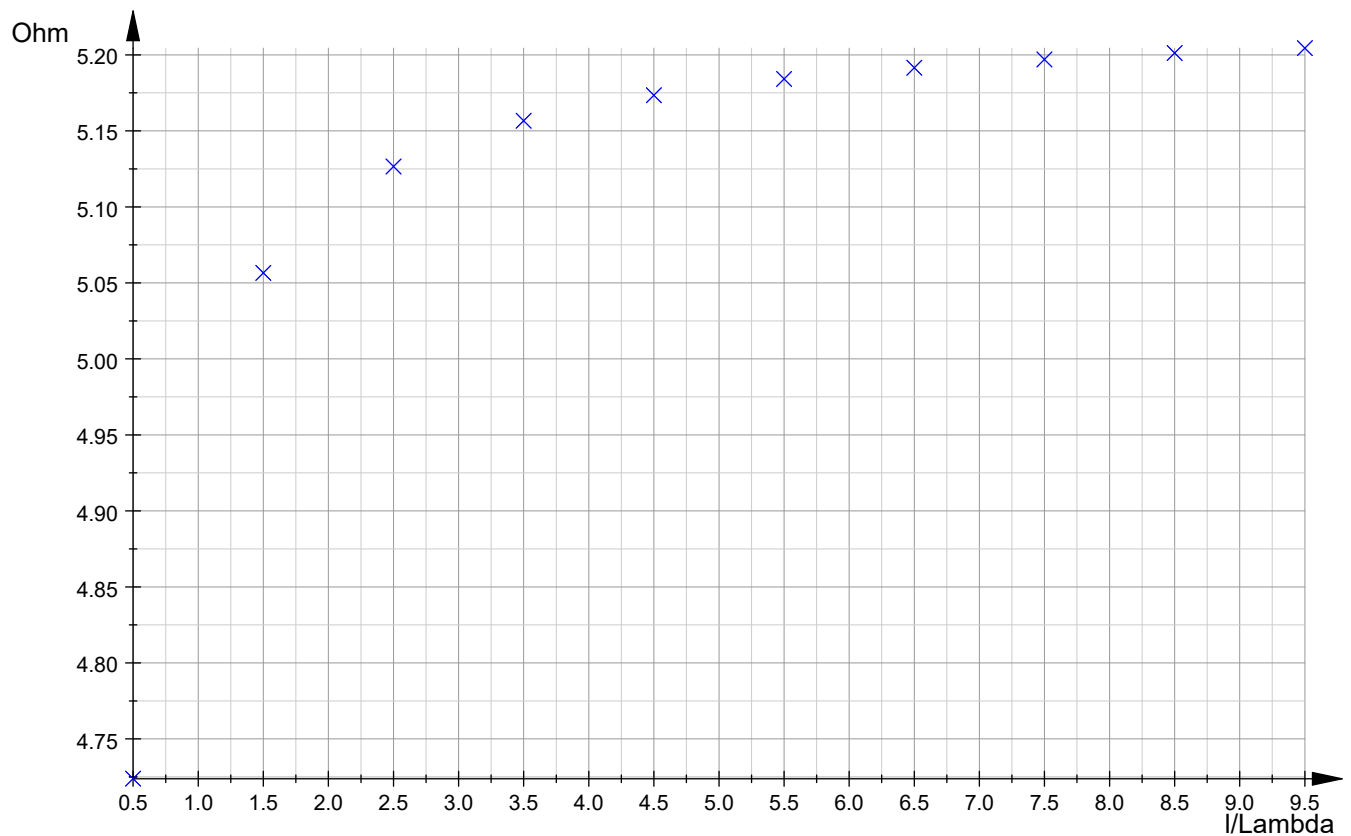
- `Liste:=[[op(Z[i],1),Re(op(Z[i],2)),RGB::Blue] $ i=1..10]:`
- `plot(plot::PointList2d(Liste, PointStyle=XCrosses, PointSize=2, Color=RGB::Blue, GridVisible=TRUE, SubgridVisible=TRUE,`

```
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]:`
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Width=180*unit::mm, Header="Imaginärteil der Dipolimpedanz")):`

## Imaginärteil der Dipolimpedanz



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Impedanz verschiedener Dipole des Durchmessers  $d$ , geradzahliges Vielfaches 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`

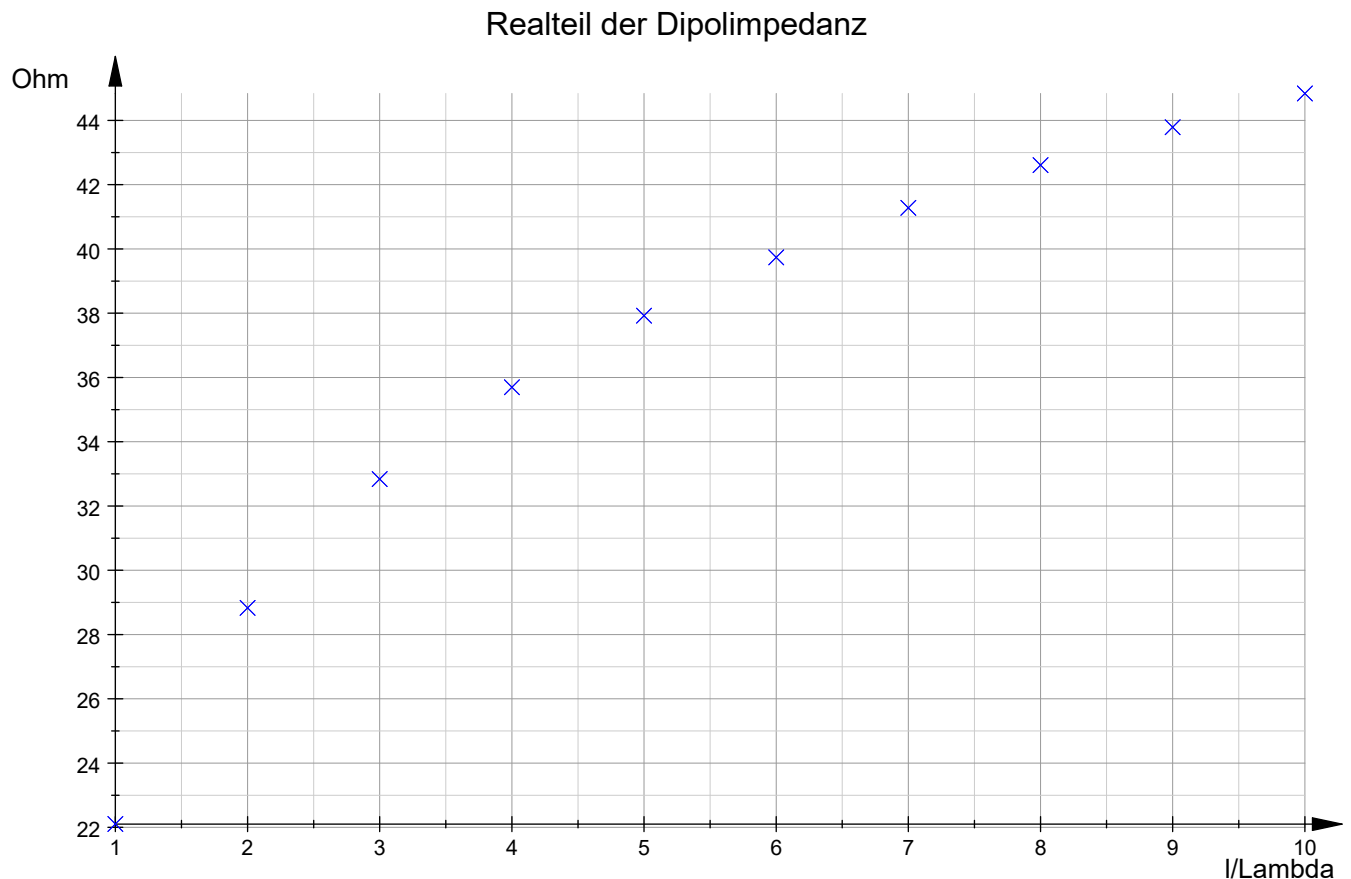
- `Z;`

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1 = [1, 22.10545392 + 13.92511407 · i]
2 = [2, 28.82814808 + 14.78141254 · i]
3 = [3, 32.83826743 + 15.08225194 · i]
4 = [4, 35.69810417 + 15.23474297 · i]
5 = [5, 37.92086971 + 15.32685608 · i]
6 = [6, 39.73909846 + 15.38825104 · i]
7 = [7, 41.27721771 + 15.43225375 · i]
8 = [8, 42.610097 + 15.46528871 · i]
9 = [9, 43.78607497 + 15.49100157 · i]
10 = [10, 44.83864271 + 15.51113502 · i]

```

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### Imaginärteil der Dipolimpedanz

