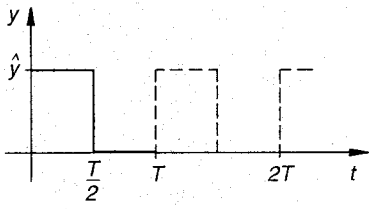
Fourier-Reihen-Tabelle

Quelle: Lothar Papula, Mathematische Formelsammlung, Vieweg, Braunschweig/Wiesbaden 2001, ISBN 3-528-64442-7, Tabelle Seite 186 bis 188

1. Rechteckskurve

$$y(t) = \begin{cases} \hat{y} & 0 \le t \le \frac{T}{2} \\ \text{für} & \\ 0 & \frac{T}{2} < t < T \end{cases}$$

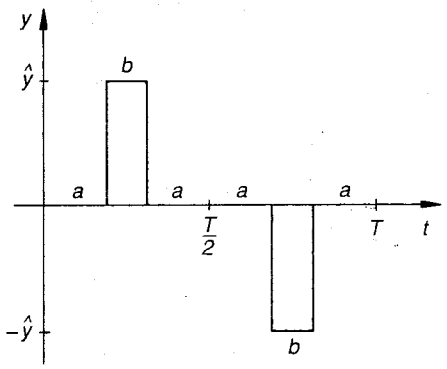


$$y(t) = \frac{\hat{y}}{2} + \frac{2\hat{y}}{\pi}\left(\sin(\omega_0 t) + \frac{1}{3}\cdot\sin(3\omega_0 t) + \frac{1}{5}\cdot\sin(5\omega_0 t) + \ldots\right)$$

2. Rechtecksimpuls

Impulsbreite: $b = \frac{T}{2} - 2a$

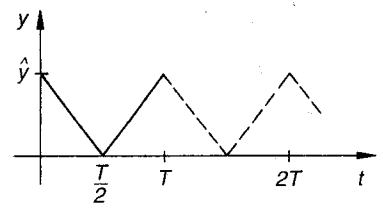
$$y(t) = \begin{cases} \hat{y} & a < t < \frac{T}{2} - a \\ -\hat{y} & \text{für } \frac{T}{2} + a < t < T - a \\ 0 & \text{im übrigen Intervall} \end{cases}$$



$$y(t) = \frac{4\hat{y}}{\pi}\left(\frac{\cos(\omega_0 a)}{1}\cdot\sin(\omega_0 t) + \frac{\cos(3\omega_0 a)}{3}\cdot\sin(3\omega_0 t) + \right.$$
$$\left. + \frac{\cos(5\omega_0 a)}{5}\cdot\sin(5\omega_0 t) + \ldots\right)$$

3. Dreieckskurve

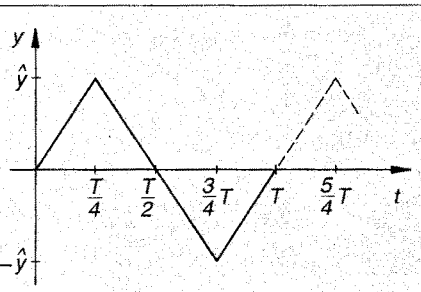
$$y(t) = \begin{cases} -\frac{2\hat{y}}{T}t + \hat{y} & 0 \le t \le \frac{T}{2} \\ \text{für} & \\ \frac{2\hat{y}}{T}t - \hat{y} & \frac{T}{2} \le t \le T \end{cases}$$



$$y(t) = \frac{\hat{y}}{2} + \frac{4\hat{y}}{\pi^2}\left(\frac{1}{1^2}\cdot\cos(\omega_0 t) + \frac{1}{3^2}\cdot\cos(3\omega_0 t) + \frac{1}{5^2}\cdot\cos(5\omega_0 t) + \ldots\right)$$

4. Dreieckskurve

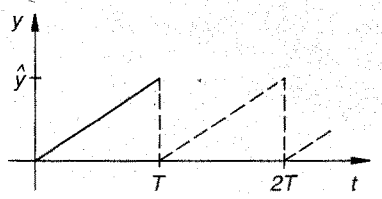
$$y(t) = \begin{cases} \frac{4\hat{y}}{T}\,t & 0 \le t \le \frac{T}{4} \\ -\frac{4\hat{y}}{T}\,t + 2\hat{y} & \text{für } \frac{T}{4} < t < \frac{3}{4}\,T \\ \frac{4\hat{y}}{T}\,t - 4\hat{y} & \frac{3}{4}\,T \le t \le T \end{cases}$$



$$y(t) = \frac{8\hat{y}}{\pi^2}\left(\frac{1}{1^2}\cdot\sin(\omega_0 t) - \frac{1}{3^2}\cdot\sin(3\omega_0 t) + \frac{1}{5^2}\cdot\sin(5\omega_0 t) - + \ldots\right)$$

5. Kippschwingung (Sägezahnimpuls)

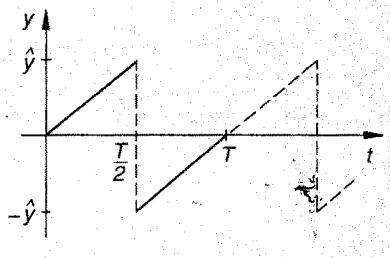
$$y(t) = \frac{\hat{y}}{T}\,t, \qquad 0 \le t < T$$



$$y(t) = \frac{\hat{y}}{2} - \frac{\hat{y}}{\pi}\left(\sin(\omega_0 t) + \frac{1}{2}\cdot\sin(2\omega_0 t) + \frac{1}{3}\cdot\sin(3\omega_0 t) + \ldots\right)$$

6. Kippschwingung (Sägezahnimpuls)

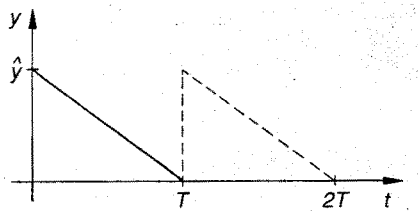
$$y(t) = \begin{cases} \frac{2\hat{y}}{T}\,t & 0 \le t \le \frac{T}{2} \\ & \text{für} \\ \frac{2\hat{y}}{T}\,t - 2\hat{y} & \frac{T}{2} < t < T \end{cases}$$



$$y(t) = \frac{2\hat{y}}{\pi}\left(\sin(\omega_0 t) - \frac{1}{2}\cdot\sin(2\omega_0 t) + \frac{1}{3}\cdot\sin(3\omega_0 t) - + \ldots\right)$$

7. Kippschwingung (Sägezahnimpuls)

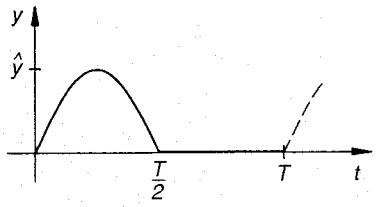
$$y(t) = -\frac{\hat{y}}{T}\,t + \hat{y}, \qquad 0 \le t < T$$



$$y(t) = \frac{\hat{y}}{2} + \frac{\hat{y}}{\pi}\left(\sin(\omega_0 t) + \frac{1}{2}\cdot\sin(2\omega_0 t) + \frac{1}{3}\cdot\sin(3\omega_0 t) + \ldots\right)$$

8. Sinusimpuls (Einweggleichrichtung)

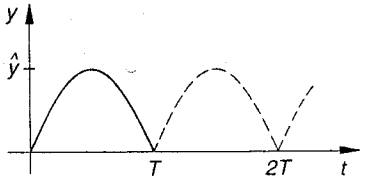
$$y(t) = \begin{cases} \hat{y} \cdot \sin(\omega_0 t) & 0 \le t \le \frac{T}{2} \\ \text{für} & \\ 0 & \frac{T}{2} \le t \le T \end{cases}$$



$$y(t) = \frac{\hat{y}}{\pi} + \frac{\hat{y}}{2} \cdot \sin(\omega_0 t) - \frac{2\hat{y}}{\pi}\left(\frac{1}{1 \cdot 3} \cdot \cos(2\omega_0 t) + \frac{1}{3 \cdot 5} \cdot \cos(4\omega_0 t) + \right.$$
$$\left. + \frac{1}{5 \cdot 7} \cdot \cos(6\omega_0 t) + \ldots\right)$$

9. Sinusimpuls (Zweiweggleichrichtung)

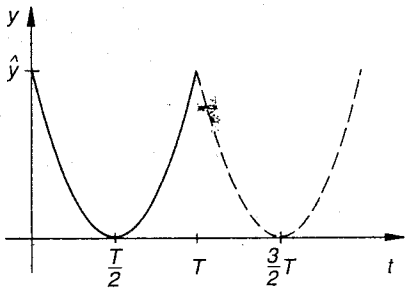
$$y(t) = \hat{y}\,|\sin(\omega_0 t)|, \qquad 0 \le t \le T$$



$$y(t) = \frac{2\hat{y}}{\pi} - \frac{4\hat{y}}{\pi}\left(\frac{1}{1 \cdot 3} \cdot \cos(2\omega_0 t) + \frac{1}{3 \cdot 5} \cdot \cos(4\omega_0 t) + \right.$$
$$\left. + \frac{1}{5 \cdot 7} \cdot \cos(6\omega_0 t) + \ldots\right)$$

10. Parabelbögen

$$y(t) = \frac{4\hat{y}}{T^2}\left(t - \frac{T}{2}\right)^2, \qquad 0 \le t \le T$$



$$y(t) = \frac{\hat{y}}{3} + \frac{4\hat{y}}{\pi^2}\left(\frac{1}{1^2} \cdot \cos(\omega_0 t) + \frac{1}{2^2} \cdot \cos(2\omega_0 t) + \frac{1}{3^2} \cdot \cos(3\omega_0 t) + \ldots\right)$$