

Exercise

Fourier-Transformation of Time-Discrete Signals

The starting point of this exercise is the discrete cosine-transformation DCT-II. It is often used in audio and image compression, such as JPEG.

$$X(h) = \sum_{n=0}^{N-1} x(n) \cdot \cos\left(\frac{\pi}{N}\left(n + \frac{1}{2}\right)k\right)$$

- a) Calculate the three filters for the basis functions of the DCT while using the values:

$$0 \leq k < N$$

$$N = 3$$

$$0 \leq n \leq N$$

- b) Determine the Fourier-transform of the basis functions by real and imaginary parts.
- c) Sketch the magnitude of the transfer function of $H_k(f)$ within the value range $-\frac{1}{2T} \leq f \leq \frac{1}{2T}$ specifying all characteristic values.