Applied Signal Processing and Computer Science
WS 11/12

Tutorial 5: Fourier Transform

1.   Proof of laws of the Fourier Transform:

1.1. Prove the following laws of the Fourier Transform:

- shift: $u(t - t_0) \leftrightarrow U(f) e^{-j2\pi f t_0}$

- derivatives: $\dfrac{d}{dt} u(t) \leftrightarrow j2\pi f U(f)$

challenging:

- convolution: $u(t) * h(t) \leftrightarrow U(f) \cdot H(f)$

2.   Fourier Transform:

2.1. Plot the following signals and calculate their Fourier transformed functions:

- $u(t) = rect\left(\dfrac{t}{\Delta t}\right)$

- $u(t) = rect\left(\dfrac{t}{\Delta t} - \dfrac{1}{2}\right)$

Compare the moduli of the spectra $|U(f)|$ of the signals.

2.2. Evaluate the spectrum $U(f)$ of the following signal $u(t)$ and plot $U(f)$.

- $u(t) = sinc\left(\dfrac{t}{T}\right) \cdot \exp\left(j2\pi \dfrac{1}{T} t\right)$