

## Fourier transform

1. Find the Fourier transform of the following functions

$$f_1(t) = \begin{cases} 1, & \text{for } |t| < 1; \\ 0, & \text{otherwise.} \end{cases} \quad f_2(t) = \begin{cases} \sin t, & \text{for } |t| < \pi; \\ 0, & \text{otherwise.} \end{cases}$$
$$f_3(t) = \begin{cases} 1 - |t|, & \text{for } |t| < 1; \\ 0, & \text{otherwise.} \end{cases} \quad f_4(t) = e^{-2|t|}.$$

2. Represent the functions  $f_1$ ,  $f_2$ , and  $f_3$  from the above item as Fourier transforms.
3. Find the half-range Fourier representations for the function  $f(t) = e^{-t}$
4. Evaluate the convolution

$$(u(t+1) - u(t-1)) * e^{-|t|}$$

and find its Fourier transform. (Here  $u$  is the Heaviside function).