Lund University
Department of Electrical and Information Technology

Systems and Signals, EITF75 Task 2 (out of 2)

Deadline: Complete the task, and hand it in in the course mailbox at the third floor no later than Monday October 19, 08.00. Email is accepted in case of travel, sickness, etc.

Write your name on every paper
Statements must be well motivated by reasoning and/or equations Points from the tasks will be added to the examination score Maximum total score (exam + 2 tasks) = 5.0+0.5+0.5=6.0p Exam Grading: 3 (>2.9p), 4 (>3.9p), 4 (>4.9p)

1. Assume a signal s(t) with (analog) Fourier Transform

$$S(F) = \begin{cases} 1 - |F|/10000, & |F| \leq 10000\ Hz, \\ 0 & Otherwise. \end{cases}$$

Sample the signal with sampling frequency $F_s = 10000\ Hz$ to obtain s(n). Let s(n) be the input to a filter with transfer function

$$H(z) = \frac{1}{1-0.5z^{-1}}.$$

Determine the output of the filter.

2. A signal s(t) has an analog Fourier Transform that satisfies

$$S(F) \neq 0,\ 4000 \leq |F| \leq 6000 \text{ and 0 otherwise}$$

Assume the following processing of the signal s(t):

(I) Sample the signal with sampling frequency $F_s = 20000\ Hz$ to obtain s(n)
(II) Construct $y(n) = s(n)\left[e^{i2\pi n0.1} + e^{-i2\pi n0.1}\right]$
(III) Low pass filter $y(n)$ with an ideal low pass filter with normalized cutoff $f_c = 0.25$.
(IV) Perform D/A conversion with sampling frequency $F_s = 10000\ Hz$.

Plot the analog Fourier transform of the resulting time signal.