



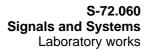
Laboraty work 1, assignments

Work 1 FREQUENCY ANALYSIS OF SIGNALS USING MATLAB

Group members:	and										
Date:/ 200 Time _	Assistant:										
A) Getting acquaintent with Matlab											
• Ask for help, if you get stuck i	are there to help and give guidance! nto some point or your program doe ved during the work. Assistant chec										
There are some additional ques	tions in this work that are marked w	ith symbol @ to be solved in the report.									
A1. ● Start Matlab, open Matlab	o's editor by typing 'edit' and write th	e following program listing:									
%Setting sample frequence	cy Fs.										
<pre>%Step size (time between t = (0:1/Fs:1-1/Fs); %Signal to be sampled. x = cos(2*pi*5*t); %Printing to the screen. plot(t,x); %Putting grid on. grid on;</pre>	e) available. Double clicki										
Notice semicolons in the end of command window of Matlab.	every command. Thanks to them th	ne content of a vector doesn't print to the									
 Study the listing above and us assistant to check your answers 		ng questions. After answering, call the									
How long is the time between sa	amples (sampling period)?	Ts =									
How many samples are taken fr (Hint: You can check the result i	om a signal altogether? In the command window by typing π	$N = \underline{\hspace{1cm}}$ $\max(size(t)))$									
How many samples are taken fr	om one period of signal?	N1 =									
$@$ What would the step size f_0 b	e in discrete frequency domain?	f ₀ =									
 Save listing by name test1, as 	ssistant gives the right directory. Ma	ke sure that the saved file ends with .m,									

in other words check that there is a listing named test1.m in the directory. Don't close the editor, so you can

easily make changes to the listing (macro).





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- Run the file in Matlab. You'll get a graph reminding a sine wave. According to Nyquist's theorem the sample frequency is sufficcient, but for plotting there are too few samples. With plot-command Matlab connects points to each other with a straight line. If needed, Matlab shows sample points for example with *-marks (included in plot-commands parameters).
- Give more adequate value for sample frequency Fs in editor, save the file with the same name and run the file in Matlab.

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- Change the frequency of sampled signal to 200 (Hz) and value of Fs to 1000 (Hz).
- Add the following lines under the formula, before plot-command (notice big X!):

```
N = \max(size(x);
X = abs(fft(x))*2/N;
```

Command fft makes a fast Fourier-transform to a time vector (the signal) based on N sample values. Abscommand calculates absolute values (amplitudes) for the transform from its complex form. Factor 2 scales the values of frequency vector (spectrum) X appropriate for a single-side spectrum. Division by N scales the spectrum values to be right ones.

• Add this command under the line just written:

```
F = (0:1:Fs-1);
```

With this command the frequency scale becomes right. The scale begins from zero, not from one. That's why Fs-1 in the end.

• Change plot to form:

plot(F,X);

- Save file by name test1 and run file in Matlab.
- A3. Answer the following questions now. After answering, call the assistant.

zoom!

Observations and explanations of the spectrum component at 200 Hz (amplitude and shape)? Remember to

Why is there a spectrum component also at 800 Hz?

• Change the frequency f to value 600 and run the listing. Explanation to phenomenon? How should listing be changed? Let the assistant check your answer!