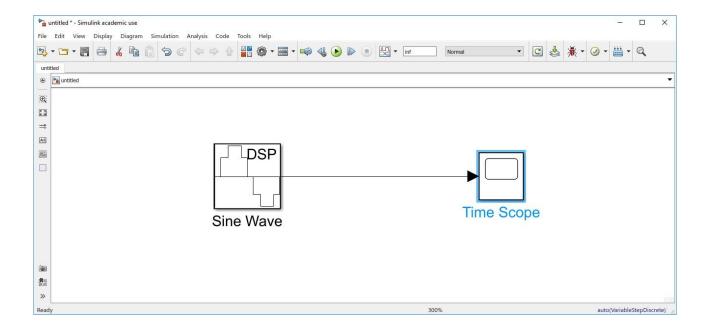
Digital filtering with Matlab and Simulink

Open Matlab. Start Simulink Interface.

FIRST PART: Using simulink as signal generator. Generate a sinusoid, to be observed on the oscilloscope.

- Open Simulink;
- Select Blank_model;
- Open the library;
- Insert the block needed and create the model, according to the below figure;



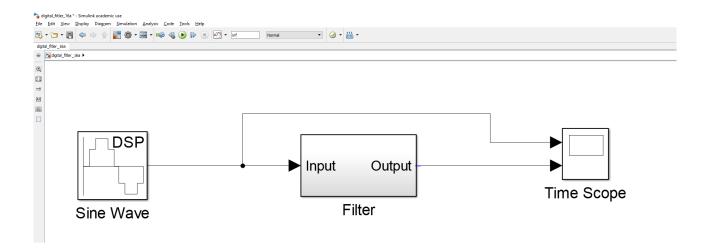
- Set the Sine Wave parameters as follows:
 - 1. Amplitude = 1 V
 - 2. Frequency = 1e3 Hz
 - 3. Phase offset = 0;
 - 4. Simple mode = Discrete;
 - 5. Output complexity = Real;
 - 6. Computation method = Trigonometric fnc;
 - 7. Sample Time = 1/44100 s
 - 8. Sample per frame = 1024;

Compare the plot with that obtained in the previous experience.

EXERCISE: find the spectrum analizer block in the library. Connect such a block and verify the spectrum of the generated sinewave.

SECOND PART: Usign simulink as lowpass filter. FilterDesigner: Matlab tool to create digital FIR filters

- Digit *filterDesigner* into Matlab command line;
- Set the filterDesigner parameter Fs (sample frequency) to 44.1 KHz;
- Set the other parameters at your choice;
- Verify the characteristic function of the designed filter through the spectrum analyzer and the time scope;
- Save the screenshots for your report.



Complete the Table

frequency	Attenuation [dB]

THIRD PART: Simulate an RC filter

- Modify the FilterDesign parameters in order to obtain the characteristic function of the RC implemented in the last experience;
- Go back to the previous experience (RC filter). Observe the attenuation correspondig to different frequencies through the oscilloscope (FFT option). Consider all frequencies attenuated less than Apass as "bandpass". Consider all frequencies attenuated more than Astop as "stopband". Identify Fpass and Fstop accordingly (obviously, the cut off frequency is always between them);
- Re-design the low pass digital filter via FilerDesign to fit the values obtained by the measurements at the previous point;
- Verify the characteristic function of the filter obtained via spectrum analyzer and time scope.

FOURTH PART: Improve the digitar FIR filter characteristic function with a constrained number of coefficients. E.g., set the number of coefficients to 200.

Re-generate the filter accordingly. Then, add the new filter to the model and compare it to the previous one in the terms of characteristic function.

