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Practical One
SystemView Revision

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1 Introduction

In this practical you will have a chance to review your experience with the simulation package, SystemView. Most importantly, you will gain a better appreciation of the operation of a time domain simulator, how to minimise the amount of data that must be simulated, and how to link the data to other applications, for further processing.

2 Time and Frequency Domain

SystemView is a time domain simulator, but has built in transforms to the frequency domain, via its analysis window. Suppose we wish to simulate a radar or communication system that sends pulses of 1μsec at a rate of 100 kHz by modulating a 2.4GHz carrier. You should now carry out the following tasks:

2.1 Set up basic simulation

Set up the simulation in SystemView, explaining the tokens that you are using. If you have no experience of modulation, this simple "on/off" modulation can be set up by switching the carrier on and off via a switch, or, by multiplying it by a waveform that varies between zero and some value, being zero except for when the pulse must be radiated.

How did you chose the simulation sampling frequency? How long must the simulation be in order to show about 10 pulses in the time domain window.

2.2 Use the analysis window to show time and frequency

Switch to the Analysis window and firstly set up a time domain window. Satisfy yourself that the values shown fit in with the simulation asked for. How many samples are available? How many cycles of the carrier exist during a pulse. Zoom in and check this.

Now switch to the frequency domain: use "help" if you have forgotten how to do this. What transform did you use. Explain in detail what you are seeing. Try some experiment e.g. make the pulse length much longer. What are the amplitudes shown on the frequency plot (i.e. what impedance did you set for the sink, and knowing the voltage of the waveform and the duty cycle, do the values in SystemView seem correct)? Does the frequency axis make sense? SystemView quotes a resolution, *dF* for the frequency axis: how is this calculated? Learn how to zoom in and out of both the frequency and time domain plots.

2.3 Add frequency conversion and decimation.

Use a multiplier token to modulate your pulsed carrier with a fixed sinusoid at 2300MHz. Have a look at the time and frequency domain of the output waveform. Predict what is happening mathematically.

What you will observe is that we have a spectrum around the difference between the carrier frequency and the local oscillator (i.e. (2400-2300=100)MHz. This is known as the *Intermediate Frequency.* There is also a spectrum around the sum of the two (4700MHz). Can you see the latter? If not, why not? Hint: what simulation frequency did you use?

Fix your simulation so that both spectra are visible. Use a low pass filter token to remove the upper frequency sidebands (around 4700MHz). What is the highest, substantial frequency in the intermediate frequency? How many times larger is the simulation sampling frequency than this highest component? Now, have a look for a token that decimates samples i.e. it takes only every so many samples of the output record, and creates a new, shorter record. Take note of the options for interpolation and which sample to use.

Now, decimate the intermediate frequency record to the smallest number of samples required to be able to display the frequency domain faithfully. How did you chose this? (Hint: what is the Nyquist criterion for the intermediate frequency?)

2.4 Output SystemView to a data file

Find the token that allows you to write SystemView values to a data file. (Notice for example, that you can write out sound files). Predict what should be contained in the file. Read the file you have created into an editor, and show that you have what is expected. Finally, read the file into your favourite analysis package (such as Matlab, Octave or even Open Office) and plot the results, comparing them to your SystemView results.

2.5 Report

Write a short, summary report of this experiment, quoting key results, and answering the questions asked. You must use OpenOffice Writer or Lyx to produce your report.