Assignment 10

In this assignment, we study some of the non-idealities in first order delta-sigma modulators.

Setup

Replace the ideal integrator with the real integrator from the tool box. Write a Matlab file (initialize.m) to initialize the parameters of the real integrator.

Integrator non-idealities

Set the input to an amplitude of 0.5, frequency to 1 KHz (in rads/ sec) and a sampling time to 2.5μs. Set a saturation voltage of 1.5V and a sampling time of 2.5μs for the real integrator. In the integrator, alfa models the gain errors and is 1 for an ideal integrator. SR models the slew rate (for example 100e6 = 100V/μs). GBW models the amplifier gain-bandwidth product. Set alfa to 1, SR to 100e6 and GBW to 100e6. In the relay, set the trip point = 0V and ±Vref = ±1V. Simulate the ADC and use the scope function from the sinks library to view the wave forms. Check the output of the integrator for saturation.

Now, set the input amplitude to 0 and the bias in the sine source to 0.1. Plot the spectral output. What do you see?

Set the input amplitude back to 0.5 and set alfa to 0.9 and plot the spectrum. Repeat the simulations by changing the SR and GBW through a range of values. Also, check the integrator output in each case.

kT/C noise

Add the kT/C noise source from the toolbox as input to the non-ideal first order integrator. Set C to 2pF (2e-12), Temp = 300, k = 1.38e-23 and b = 1 in the initialization file. Plot the spectrum. Change C to 10fF (10e-15) and re-plot the spectrum. How does the spectrum change?