



# ECE 283 Lab2 Design Review

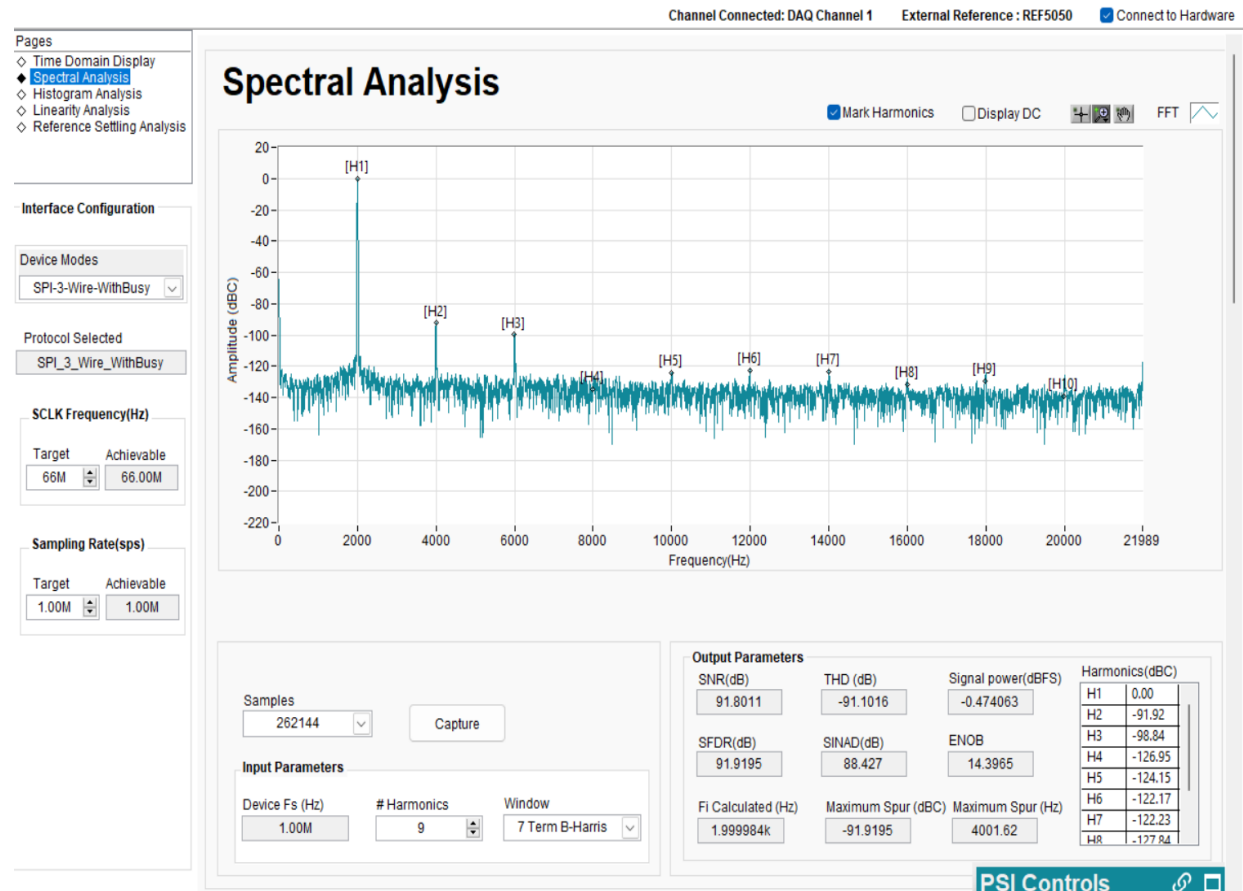
Mingjie Ma  
Chengming Li

University of California, San Diego, La Jolla, CA, USA



# 0dBFS input at 2k from EVA Board

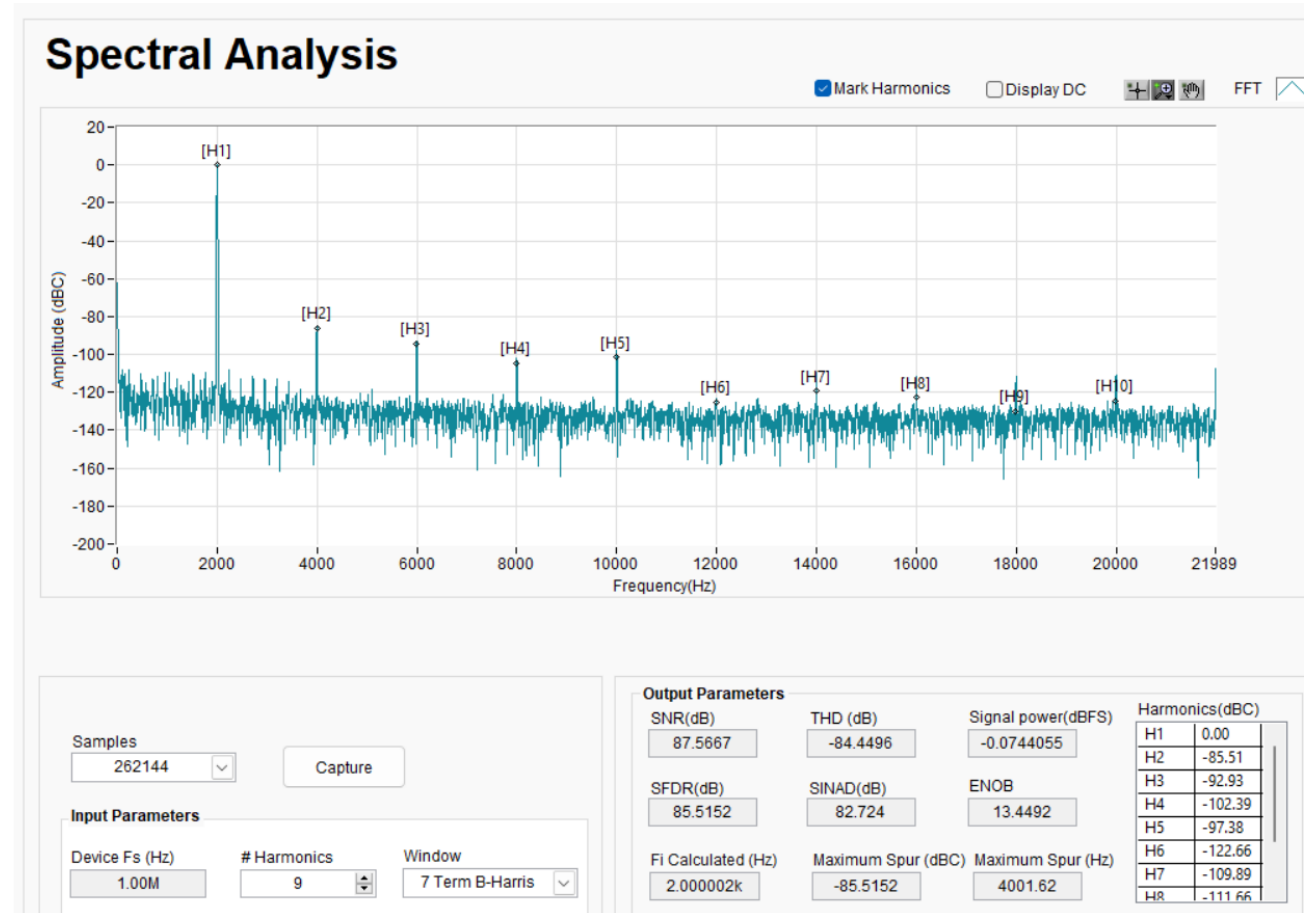
SFDR: 91.91dB  
THD: -91.10 dB  
SNR: 91.80 dB  
SNDR: 88.427  
ENOB 14.39





# 0dBFS input at 2k from FuncGen

SFDR: 85.51 dB  
THD: -84.45 dB  
SNR: 87.56 dB  
SNDR: 82.724 dB  
ENOB 13.45

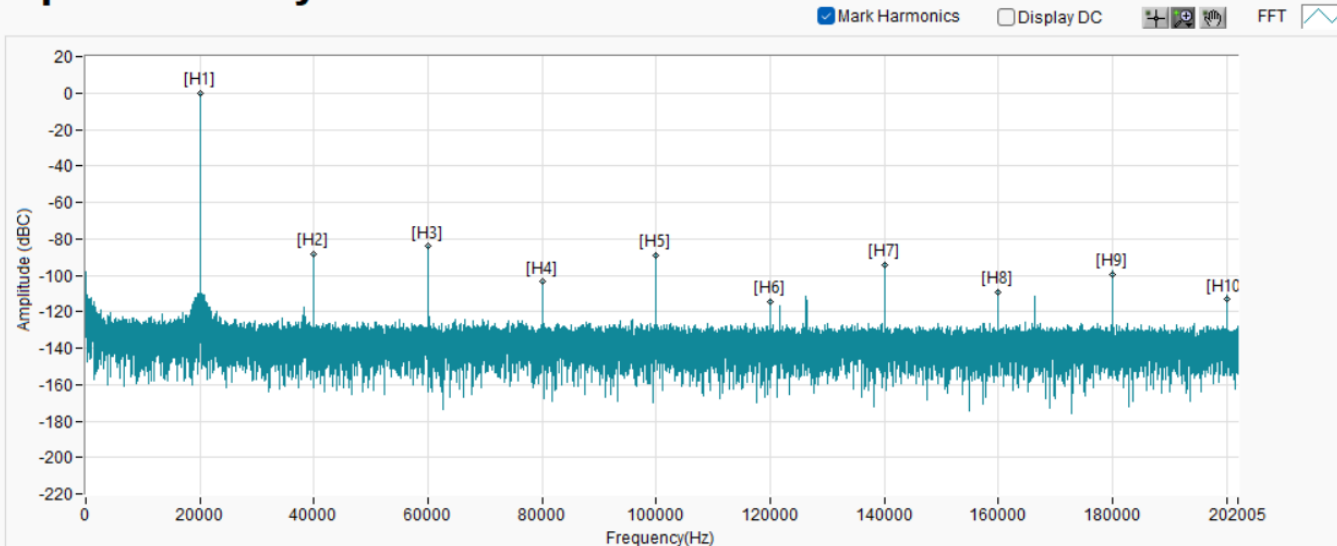




# 0dBFS input at 20k from FuncGen

SFDR: 84.00 dB  
THD: -81.15 dB  
SNR: 87.54 dB  
SNDR: 80.27 dB  
ENOB 13.04

## Spectral Analysis



Samples  
262144

### Input Parameters

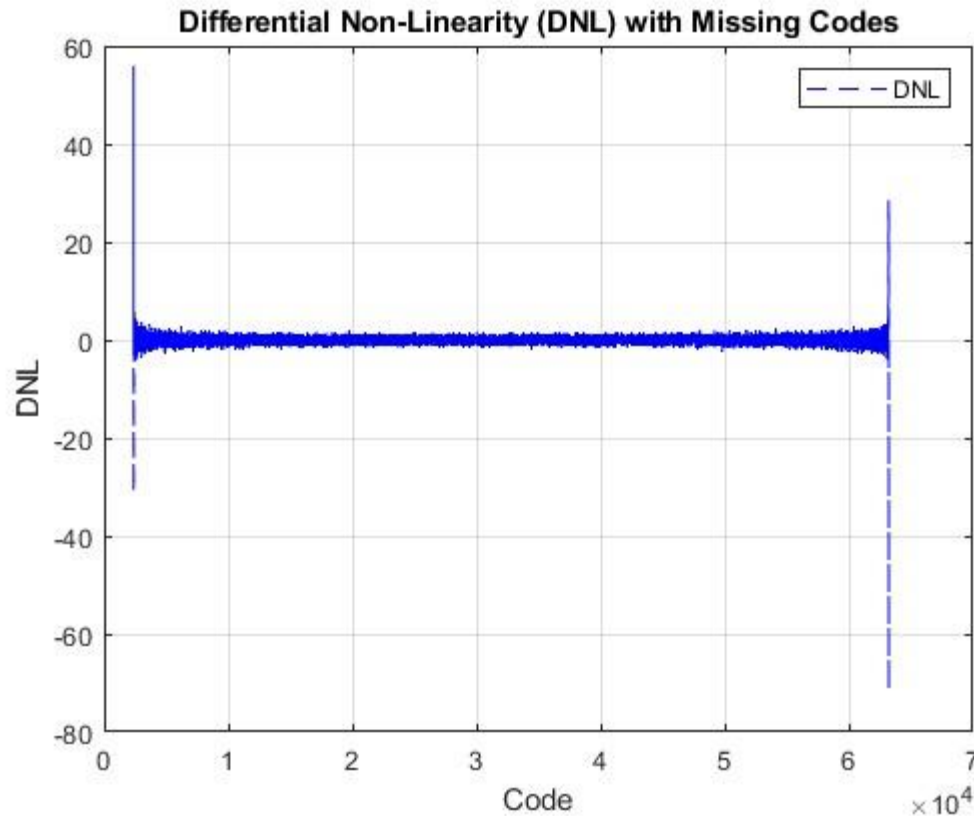
Device Fs (Hz) 1.00M # Harmonics 9 Window 7 Term B-Harris

### Output Parameters

SNR(dB)	THD (dB)	Signal power(dBFS)	Harmonics(dBC)
87.6441	-81.1564	-0.266331	H1 0.00
SFDR(dB)	SINAD(dB)	ENOB	H2 -88.41
84.0031	80.2768	13.0427	H3 -84.00
FI Calculated (Hz)	Maximum Spur (dBC)	Maximum Spur (Hz)	H4 -103.07
20.000018k	-84.0031	60001.4	H5 -88.33
			H6 -113.63
			H7 -92.81
			H8 -107.85

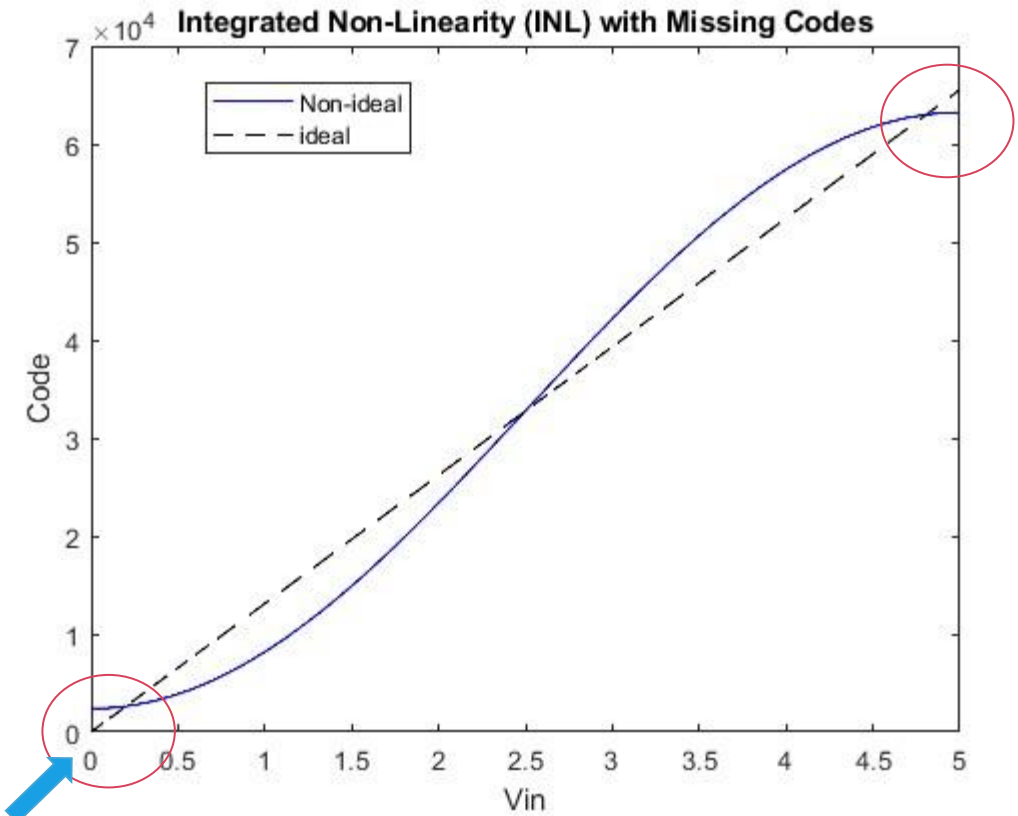


# INL and DNL from TI



DNL

$$DNL(n) = \frac{Hit(n+1) - Hit(n)}{Ideal\ Hit}$$



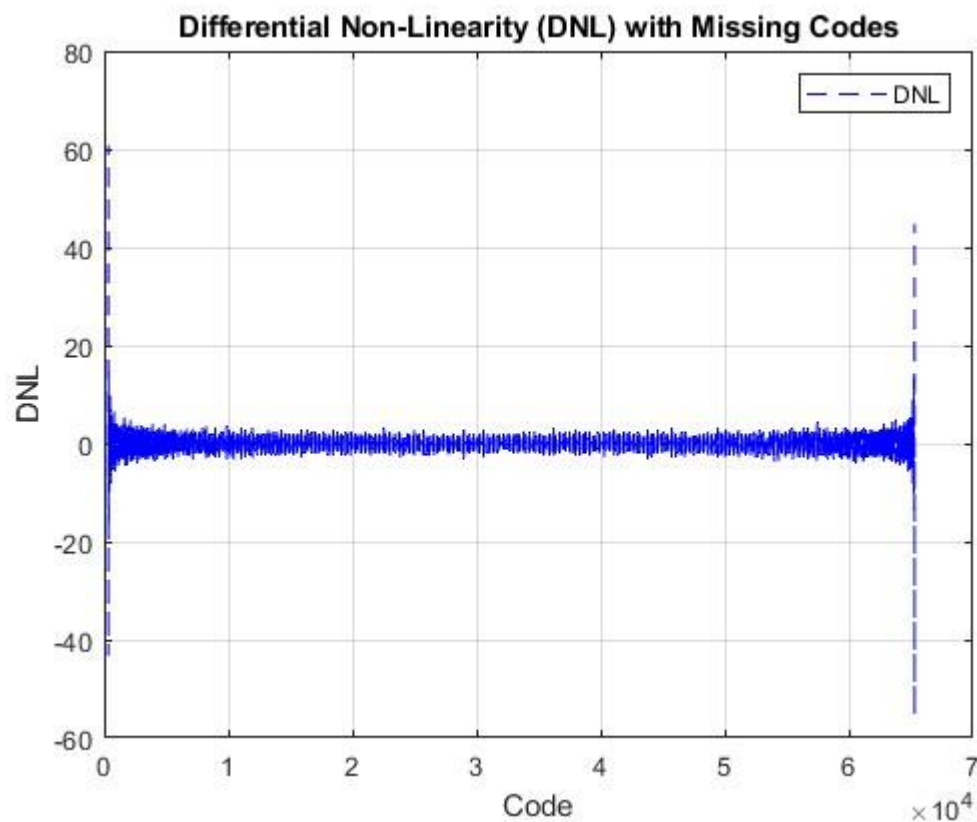
INL

Missing few of codes

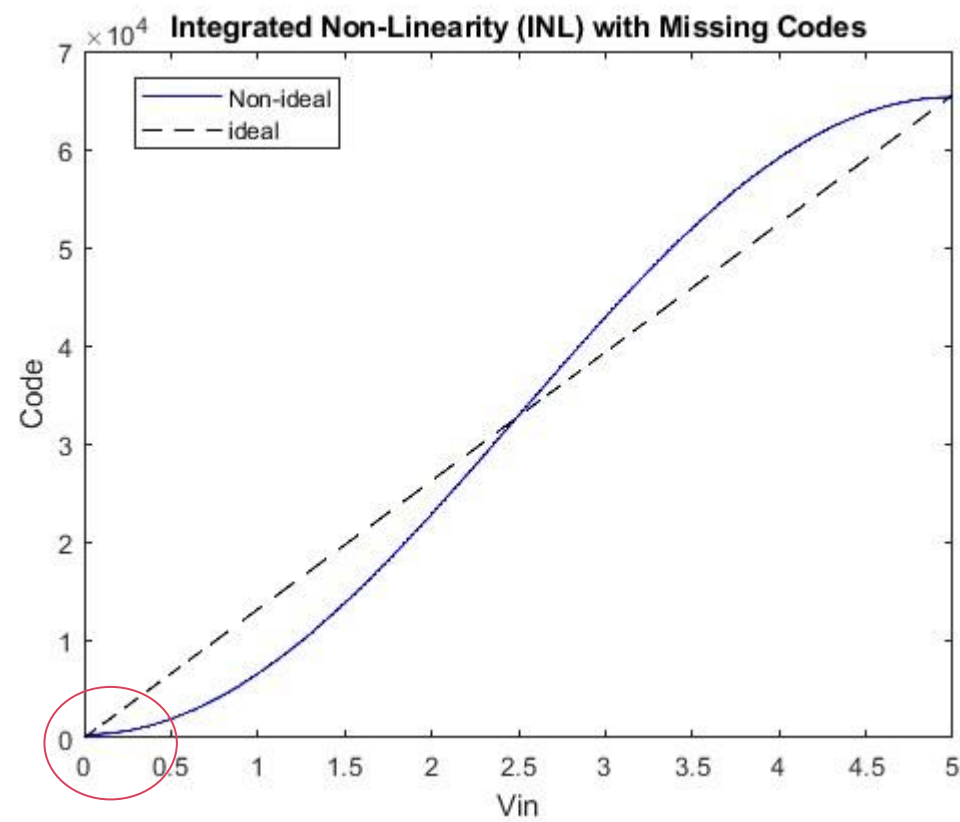
Notes: just found a canvas note about INL/DNL in Matlab, these plots will be replotted



# INL and DNL from FuncGen



$$DNL(n) = \frac{Hit(n+1) - Hit(n)}{Ideal\ Hit}$$



More codes  
are used



# Remote Control Code

## AFG3002C\_Control Lib in python

- FuncGenConnect
- voltage\_setup
- sinusoid\_setup
- output\_ON/OFF
- GetADCData

Codes are developed based on the programmer's manual

### Example:

# Set the Amplitude

"SOURce1:VOLTage:LEVel:IMMediate:AMPLitude 1V"

```
[30] # Check if the device is there
      rm = pyvisa.ResourceManager()
      instruments = rm.list_resources()
      print(instruments)

... ('GPIB0::11::INSTR',)

▷ # 'GPIB0::11::INSTR'
  AFG_handle = AFG.FuncGenConnect(INSTRUMENT_ID)
  if not AFG_handle:
      print('Could not find instrument, aborting...')
      quit()

  AFG.voltage_setup(AFG_handle, 2,0,5)
  AFG.sinusoid_setup(AFG_handle,2,2.5,5,2e3,0)

[31]

... TEKTRONIX,AFG3052C,C011088,SCPI:99.0 FV:1.0.10
```



# SFDR Measurement

- Ongoing measurement...
- More data needed to be collected on Wednesday

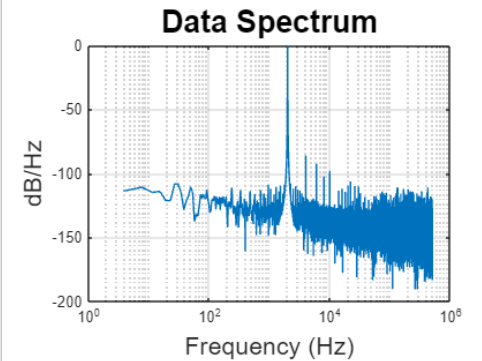
## Data processing

```
clearvars
% Read the Bin data
src_path = './Data2';
fileID = fopen('./Data2/output-freq-1.227542e+05.bin');
bin_data = fread(fileID,'uint16');
freq = 1.227542e+05;

% Remove the zeros
filtered_data = bin_data(bin_data ~= 0);
filtered_data = filtered_data';
Data_filt = bin_data(1:4:end);
% disp(filtered_data);
```

## Calculate SNDR

```
Fs=1e6;
num_segments=1;
f_signal = 2000;
f_s = Fs;
BW = 500e3;
sample_size=2^18;
periodogram_length = sample_size / num_segments;
fbin = f_s / periodogram_length;
plotYN = 1; plotAll = 0; plotHold = 0; plotLin = 0; datNorm = 1;
[sinusoid_power, data_minus_sinusoid_in_BW_power, SNDR, ENOB,HD2,HD3] = ...
    plot_periodogram_SFDR(Data_filt, periodogram_length, num_segments, f_signal, ...
        f_s, BW, plotAll, plotHold, plotYN, plotLin,datNorm);
fprintf('SNDR calculated within %d kHz bandwidth = %.3f dB, HD2 = %.3f and HD3 = %.3f\n', BW/1000,
    SNDR, HD2, HD3);
set(gcf,'color','w')
```



SNDR calculated within 500 kHz bandwidth = 67.606 dB, HD2 = 81

Code is adapted from canvas





# Q & A