

COURSE DESCRIPTION

Course Name: DSP For Wireless Communications
Course Start Date: Nov 9, 2023, videos released weekly
Q&A Workshops: Thu Nov 16, 30, Dec 7, 14, 21, 90 minutes
Two Time Options! 11AM EST or 4PM EST
Location: Zoom Webinar
Speaker: Dan Boschen

Pre-Recorded Videos combined with Live Q&A Workshops

This is a hands-on course providing pre-recorded lectures that students can watch **on their own schedule** and **an unlimited number of times** prior to live Q&A/Workshop sessions with the instructor. Ten 1.5 hour videos released 2 per week while the course is in session will be available for up to two months after the conclusion of the course. Two time options are offered in consideration to those in different time zones throughout the world. Workshop sessions are recorded and Dan is available via e-mail throughout the course to answer questions as well.

Course Summary

This course is a fresh view of the fundamental and practical concepts of digital signal processing applicable to the design of mixed signal design with A/D conversion, digital filters, operations with the FFT, and multi-rate signal processing. Dan's background in Wireless Communications where these concepts are used, but it more widely applicable to any DSP applications where filtering and the FFT is used. This course will build an **intuitive** understanding of the underlying mathematics through the use of graphics, visual demonstrations, and applications in GPS and mixed signal (analog/digital) modern transceivers. This course is applicable to DSP algorithm development with a focus on meeting practical hardware development challenges in both the analog and digital domains, and not a tutorial on working with specific DSP processor hardware.

2 The FFT Intuitively Explained

$$DFT = DFT_{\text{even}} + W_N^k DFT_{\text{odd}}$$

In []:

```
# signal
signal = x[1:N, M:N]
k = 50 * np.arange(0, 10)
out = fft(k * signal)
plt.figure()
plt.plot(10 * 20 * np.log10(abs(out)))
```

3 Practical Approaches for Interpolation with Polyphase Filters

In []:

```
# gives a input signal rate fs with desired interpolation by R
R = 20
# consider the following characteristics
```

Jupyter Notebooks:

This long-running course now includes Jupyter Notebooks which incorporates graphics together with **Python simulation code** to provide a “take-it-with-you” interactive user experience. No knowledge of Python is required but the notebooks will provide a basic framework for proceeding with further signal processing development using that tools for those that have interest in doing so.

This course will not be teaching Python, but using it for demonstration. A more detailed course on Python itself is covered in a separate course also taught by Dan titled “Python Applications for Digital Design and Signal Processing”.

Students will be encouraged but not required to load all the Python tools needed, and all set-up information for installation will be provided prior to the start of class.

Target Audience:

All engineers involved in or interested in signal processing applications. Engineers with significant experience with DSP will also appreciate this opportunity for an in-depth review of the fundamental DSP concepts from a different perspective than that given in a traditional introductory DSP course. Please contact Dan at boschen@loglin.com if you are uncertain about your background or if you would like more information on the course.

Benefits of Attending/ Goals of Course:

Attendees will build a stronger intuitive understanding of the fundamental signal processing concepts involved with digital filtering and mixed signal analog and digital design. With this, attendees will be able to implement more creative and efficient signal processing architectures in both the analog and digital domains. The knowledge gained from this course will have immediate practical value for any work in the signal processing field.

Topics / Schedule:

Pre-recorded lectures (3 hours each) will be distributed Friday prior to all Workshop dates. Workshop/ Q&A Sessions are at 11am-12:30pm Eastern Time and then repeated at 4pm-5:30pm Eastern Time on the dates listed below (the Workshop/ Q&A Sessions will also be recorded for later viewing):

Thursday, November 9, 2023

Course Kick-off and Orientation: 30-minute meeting to go over getting started with the course.

Thursday, November 16, 2023

Class 1: Correlation, Fourier Transform, Laplace Transform

(Week of Nov 23 is skipped for US Thanksgiving Holiday)

Thursday, November 30, 2023

Class 2: Sampling and A/D Conversion, Z –transform, D/A Conversion

Thursday, December 7, 2023

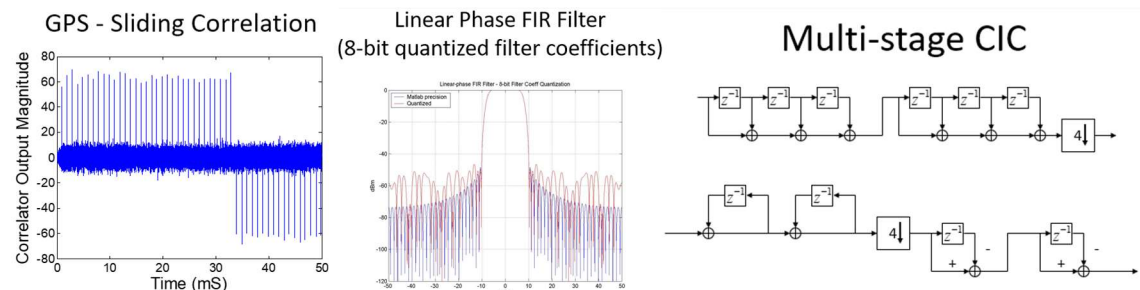
Class 3: IIR and FIR Digital filters, Direct Fourier Transform

Thursday, December 14, 2023

Class 4: Windowing, Digital Filter Design, Fixed Point vs Floating Point

Thursday, December 21, 2023

Class 5: Fast Fourier Transform, Multi-rate Signal Processing, Multi-rate Filters



Speaker's Bio:

Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems and has taught courses on DSP for over 15 years. Dan is a contributor to dsprelated.com and Signal Processing Stack Exchange dsp.stackexchange.com/, and is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

For more background information, please view Dan's Linked-In page at: <http://www.linkedin.com/in/danboschen>