

ECE 224B Spring 2007

VLSI Project Testing (4 units)

University of California, Santa Barbara  
Department of Electrical and Computer Engineering

### **Description**

This class will utilize commercially available mixed-signal ICs to elucidate how to perform bench testing to validate the performance specifications listed in the datasheet provided by the manufacturer. In particular, the class will focus on testing several analog-to-digital and digital-to-analog converters – ADCs and DACs. If time permits, a fully integrated radio-frequency phase-locked loop (PLL) IC will also be tested.

To provide the essential background for the testing assignments, the lectures will cover the following topics in details:

- (1) understanding the datasheet of a data converter IC,
- (2) fundamental of sampled systems,
- (3) data converter specifications,
- (4) data converter architectures,
- (5) testing techniques for data converters,
- and (6) test board design issues and interface circuit requirements.

From this course, the students will acquire in-depth knowledge for data converter performance specifications, design trade-off of different converter architectures, and hands-on experience of testing off-the-shelf data converters.

### **Instructor**

Prof. Patrick Yue, Harold Frank Hall, Room 5159, [cpyue@ece.ucsb.edu](mailto:cpyue@ece.ucsb.edu)  
Office hours: Tuesday and Wednesday, 4:30 – 5:30 PM

### **Lecture Time and Place**

**Mon & Wed 3:00 – 4:30 PM, ESB 1003 (Cooper Lab)**

**ECE 224B Web Site** - <http://www.ece.ucsb.edu/courses/ECE224B/>

### **Reference Text (Optional)**

*The Data Conversion Handbook*, edited by Walt Kester (Newnes, 2005)

Or you can download the chapters at:

[http://www.analog.com/library/analogDialogue/archives/39-6/data\\_conversion\\_handbook.html](http://www.analog.com/library/analogDialogue/archives/39-6/data_conversion_handbook.html)

### **Grading**

Homework Assignments & Test Reports	20%
Presentations on testing results	20%
Mid-term Exam	30%
Final Presentation & Oral Exam	30%

### **Testing Facilities**

HFH 1124 Digital Systems Instructional Lab  
HFH 5160 Electronics and Circuits Lab (if necessary)

## Course Schedule (subjected to change)

<u>Date</u>	<u>Lec.</u>	<u>Topic</u>
4/2	1	Game plan - course objective What are the purposes of a datasheet? (ADCS7476) What is evaluation board for? What is the difference between bench testing and production ATE testing?
4/4	2	Fundamentals of Sampled Systems: - Coding, Quantization, Static Transfer Functions, and DC Characteristics - Sampling Theory
4/9	3	Fundamentals of Sampled Systems: AC Characteristics (I)
4/11	4	Fundamentals of Sampled Systems: AC Characteristics (II)
4/16	5	Evaluation board set up (in Lab)
4/18	6	Testing ADC & DAC
4/23	7	PCB Design Issues and Interface Circuits
4/25	8	DAC Architectures (1)
4/30	9	<b>Presentation on DAC testing results</b>
5/2	10	DAC Architectures (2)
5/7	11	Successive Approximation ADC
5/9	12	Pipeline ADC
5/14	13	<b>Mid-Term Exam</b>
5/16		(No lecture)
5/21	14	<b>Presentation on Successive Approximation ADC testing results</b>
5/23	15	Other ADC Architectures – Flash, Sigma-Delta
5/28		Memorial Day
5/30	16	Phase-Locked Loop Basics (2)
6/4		(No lecture)
6/6		(No lecture)
6/12		<b>Final Presentation on Pipeline ADC testing results</b> <b>Oral exam on Q&amp;A</b> <b>Final Test Report due</b>

### **Lab Schedule (more details to be provided)**

Week Lab tasks

- 1 Set up lab access  
Install National Semiconductor WaveVision 4.0 on your laptop or PC in the Lab
- 2-4 Verify the performance specification of a 30-MHz, 12-bit DAC  
(Part no. DAC121S101)
- 5-7 Verify the performance specification of a 1-MS/s, 12-bit, successive approximation  
ADC (Part no. ADCS7476)
- 8-10 Verify the performance specification of a 40-MS/s, 12-bit, pipeline ADC  
(Part no. ADC12D040)