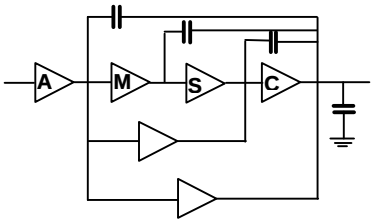
Analog and Mixed Signal Center



2000

Analog and Mixed-Signal Testing

Short Course
November 13 – 17, 2000

TEXAS A&M UNIVERSITY
Department of Electrical Engineering
College Station, Texas 77843-3128

Course Objectives

This is the premier course on analog and mixed signal testing. The instructors are leading experts in the filed with extensive research and engineering experience in design and testing of analog and mixed-signal circuits.

The course objective is to provide fundamental information on Analog and Mixed signal Testing and practical details on testing and design for testability, which are not clearly covered in the literature or users manual. This knowledge is vital for

successful design and efficient test methodology. The lectures will illustrate case studies and examples used in practice. Participants will gain solid understanding of the most important aspects of analog and mixed signal testing.

Who Should Attend

This course is intended for new and experienced electric and electronic engineers who need intensive concentrated information on the state-of-the-art of Analog and Mixed-Signal Circuits Testing. In particular this course is intended for

- IC testing engineers
- Analog and Digital Circuit Designers
- Application engineers
- Developers of IC technology for mixed-model circuits

Instructors

Gordon Roberts (S'84 – M'89) internationally know for his work on design and testing of IC's. Received the B.A. Sc. degree from the University of Waterloo**,** Canada, in 1983 and the M.A.Sc. and Ph.D. degrees from the University of Toronto, Canada, in 1986 and 1989 respect- ively, all in electrical engineering. Dr. Roberts is currently an associate professor in the Department of Electrical and Computer Engineering , and the Director of the Micro-electronics and Computer Systems Laboratory (MACS), both at McGill Univer-sity. Over the years, he has conducted extensive research on analog integrated circuit design and mixed-signal test issues. He has published over 90 papers, co-authored several textbooks related to mixed-signal test and analog integrated circuit design, and contributed 9 chapters to other books. He is past associate editor of the IEEE Transactions on Circuits and Systems, Part II, and an associate editor for the IEEE Design & Test of Computer Magazine. Prof. Roberts is a pasted Distinguished Lecturer for the IEEE Computer Society. He has received numerous department and faculty awards for teaching electronics to under-graduates, and received for his work on mixed-signal testing.

Adoracion Rueda (M'87) joined the Department of Electronics and Electromag-netism at the University of Seville in 1976 as Assistant Professor and obtained the Ph.D. degree in 1982. From now Institute of Microelectronics at Seville (IMSE). Professor in 1984 to 1996 she was Associate the Department, where she now holds the position of Professor in Electronics. In 1989, she became researcher at the Department of Analog Design of the National

She has participated in several research projects financed by the Spanish CICYT, in the ESPRIT Projects: ADCIS, AD-2000, AMATIST, ASTERIS, MICROCARD, and SPRING, and in the AFMIS Project included in the COMETT Program of the European Community.

She has published about 135 papers in international journals and major conferences or books. In 1992 she won the Best Paper Award of the 10th IEEE VLSI Test Symposium.

Her research interests are currently focussed on the topics: Design and Test of Analog and Mixed-Signal Circuits, Behavioral Modeling of Mixed-Signal Circuits and development of CAD tools.

Mani Soma received the B.S.E.E. degree from Cali-fornia State University Fresno in 1975, the M.S. and Ph.D. degrees from Stanford University in 1977 and 1980, respectively. From 1980 to 1982, he was at the General Electric Research and Development Center (Schenectady, New York), working on design and test methodologies for VLSI integrated-circuits and systems. He then joined the Department of Electrical Engineering at the University of Washington and has been a Professor since 1988. He was the Associate Director of the NSF Center for Design of Analog Digital ICs from 1989 to 1994. He founded and chaired the IEEE Mixed-Signal Test Bus Standard Working Group (1149.4) from 1991 to 1995, and remains active in standard development. He was Technical Program Chair for ISCAS 1995 and helped found the Pacific Northwest Test Workshop, which has become the annual IEEE International Mixed-Signal Testing Workshop. For these works, he received the IEEE Computer

Society Meritorious Service Award (1995) and the IEEE Computer Society Golden Core Award (1977). He has published papers in electronic design, test, and reliability; and has more recently focused on research in mixed analog-digital system design and test. He was elected IEEE Fellow "for contributions to mixed analog-digital system design-for-test." He cooks, gardens, and teaches folk dancing in addition to electrical engineering.

Course Descriptions and General Introduction

Introduction to Mixed-Signal Test

- Main test concepts
- Terminology and approaches
- Differences between digital and analog circuit testing
- General test issues in mixed-signal circuits and design and test inter-relations
- Manufacturing, faults, parametric faults, IFA

Defect-oriented Test

- Manufacturing defects
- Classification of faults
- Fault modeling and simulation
- Defect-oriented test requirements and approaches
- The IFA technique and its feasibility for mixed-signal testing

Design for Test Techniques, Part I

- Reviews BIST and unified on-and-off-line testing techniques
- Why and how to enhance testability
- DFT options for analog and mixed-signal circuits at different hierarchy levels from layout to systems
- Some techniques for structural test of filters and data converters
- Case studies of mixed-signal test in industry and academia

Design for Test Techniques, Part II

- Testers and application issues
- Analog parametric test using digital sampling
- Delta-Sigma modulation techniques

Test Application

- Test bus standards and on-chip access
- Case studies of mixed signal test in industry and academia
- Techniques to access on-chip circuits for test, using a variety of structures from multiplexers to one-wire test bus to more complex reconfiguration schemes
- The recently approved IEEE 1149.4 Mixed-signal Test Bust Standard is described with an implementation example
- Future problems in mixed-signal and promising solutions

Test Generation and Fault Simulation Techniques

- Algorithms for automatic test generation and fault simulation for analog circuits using fault models and/or functional specifications as basis
- Some algorithms are intimately tied to specific desig-for-test techniques (see previous lectures)

Case Studies and Examples

- Examples of phase-locked loops
- Examples of PWM-based power-supply circuits

Testing Challenges Ahead

- Future problems in mixed-signal test, in the context of systems-on-a-chip, IP-based designs, and high-frequency RF system design
- Promising techniques to solve these problems and a framework is described to evaluate these techniques

Workshop Schedule

TRAVEL, HOTEL, AND PARKING INFORMATION

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 8:30	Introduction	Design for Test Techniques Part I (cont)	Test Application Part I	Test Application Part III	Challenges Ahead
8:30 -10:00	Introduction to Mixed-Signal Test	Design for Test Techniques Part I (cont)	Test Application Part I (cont)	Test Application Part III (cont)	Challenges Ahead
10:00 – 10:30	BREAK	BREAK	BREAK	BREAK	BREAK
10:30 – 12:00	Defect-oriented Test	Design for Test Techniques Part I	Test Application Part II (cont)	Test Generation and Fault Simulation Techniques	Wrap-up and Resources
12:00 – 1:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1:30 – 2:00	Defect-oriented Test	Design for Test Techniques Part II	Test Application Part II (cont)	Case Studies and Examples (cont)	
2:00 – 3:00	Design for Test Techniques Part I	Design for Test Techniques Part II	Test Application Part II	Case Studies and Examples (cont)	
3:00 – 3:30	BREAK	BREAK	BREAK	BREAK	BREAK
3:30 – 4:30	Design for Test Techniques Part I	Design for Text Techniques Part II	Test Application Part II (cont)	Case Studies and Examples (cont)	

American and Continental Airlines serve College Station through Dallas and Houston. College Station is located 90 miles north of Houston Intercontinental Airport on Texas Highway 6 via Interstate Highway 45 and State Highway 105.

A partial list of local hotels is provided below. Make reservations early. Hotels marked with (*) asterisk may provide transportation to campus *if requested at check-in*.

Parking fees on campus may be paid in two ways: (1 in advance by mail with registration (least cost) and (2) on a daily basis at the parking garage on a first-come-first-serve basis.

On –Campus lodging may be obtained by call the Memorial Student Center, (409) 8945-8908.

Off-Campus Lodging:

Best Western Inn at Chimney Hill, 901 University Dr.	(979) 260-9150
Comfort Inn*, 104 Texas Ave. S.	(979) 846-7333
Days Inn College Station, 2514 Texas Ave. S.	(979) 696-6988
Fairfield Inn, 4613 S. Texas Ave.	(979) 268-1552
Hampton Inn, 320 Texas Ave. S.	(979) 846-0184
Hilton Hotel*, 801 University Dr.	(979) 693-7500
Holiday Inn-College Station, 1503 Texas Ave.	(979) 693-1736
LaQuinta, 607 Texas Ave. S.	(979) 696-7777
Ramada Inn, 1502 Texas Ave. S.	(976) 693-9891
Super 8 Motel, 301 Texas Ave.	(979) 846-8800

REGISTRATION FORM
Analog Mixed-Signal Center

Dept. of Electrical Engineering
Texas A&M University
College Station, Texas 77843-3128

Tel: (979) 845-9587
Fax: (979) 845-7161
E-mail: ella@ee.tamu.edu

Name _____
(Last) (First/Middle)
Organization_____
Job Title _____
Mail Address _____
_____
_____
Telephone _____ Fax_____
E-Mail _____

REGISTRASTION FEE** PAYMENT

One Person $1,400.00
CEU Processing Fee $ 25.00
(SS#_____)
On-Campus Parking
$6 per day x____ days $_____

TOTAL $_____

** Discounts available
For companies associated to the
Analog and Mixed Signal Center

Company Check (U.S. Dollars) $_____
Credit Card* (circle one)
Master Card Visa AmEx
Name as it appears on the card:
_____

Card #_____
Exp. Date _____
Signature_____
*Bank surcharge added for credit card payments.

Mail registration form with payment to:
AMSC, Texas A&M University)
ATTN: Ella Gallagher
Dept. of Electrical Engineering
College Station, TX 77843-3128 USA

Continuing Education Units (CEU are available upon request by marking the appropriate box on the registration form and submitting the fee. Completing the course will earn 1.4 CEU's.

Cancellation Policy Guaranteed

Registration deadline is October 24
After Oct. 24, registration is on a First-come-first-serve basis only. Registration fees will be refunded, Less a cancellation f ee of $200, if Written cancellation request is received on or before Nov. 1.
TAMU reserves the right to cancel The course, if necessary, due to low registration before Nov 5 and will provide full refund of paid registration fees.

Internet Information

This Course:
http://amsc.tamu.edu/shortcourses

Other Courses: (to be confirmed)
RF Communication Circuits
Low Voltage Analog Circuit Design
Analog to Digital Converters
Continuous-Time and Discrete-Time IC Filters

Discounts: for AMSC industrial partners.