'DPI/SFG—A Systematic Analysis Approach for Linear Circuits Including Feedback'

K*eynote Speaker: Dr. Agustin Ochoa,* Xtreme Analog Circuit Technology (XACT)

Presentation:

Circuit analysis generally consists of using one of two approaches or of combinations of these two, plus simulation: 1) Complete mathematical analysis based on Mesh/Nodal analysis using KVL/KCL and matrices, and 2) Experiential based 'insightful' approximations. The first approach, classic nodal analysis, even for circuits with only a few nodes quickly becomes algebraic intensive and the exercise becomes a mathematical effort with very little design insight gleamed from the results. Analysis/design based on experience pre-supposes that we have that experience to draw upon--Experience is not readily developed or transferred to others. Circuits with feedback complicate the analysis and are more difficult to develop intuition from the experience based approach. And simulation does not help either.

The Driving Point Impedance/Signal Flow Graph approach in contrast, is a systematic method of mapping a circuit onto a flow graph. It keeps the math contained to portions of the design and does not require insight into new topologies at the start. Once the graph is generated, graph simplification operations are used to generate desired transfer relations. The graph representation further can be used to define simulation benches to obtain full and partial results allowing for the examination of the contribution to the full response from an element, node, or sub-circuit. The resulting transfer relations are in factored form and useful for design—a 'low entropy' result. This approach is particularly useful in analyzing circuits containing feedback.

Seminar Outline:
1. DPI/SFG-I
    a. Basis and Development
    b. Simple Graph Algebra
    c. DPI/SFG on Simple Circuits
2. DPI/SFG-II
    Some more interesting circuits
        i. Finding the time constant for initial release of latching comparator
        ii. Some Active Circuits
            1. One transistor amp
            2. Inverting gain stage using a Transconductance Amplifier with feedback—The 'Miller Effect'
        iii. Revisit the latching comparator using DPI/SFG
        iv. Op Amp Basic Stage, Gain and Port Impedance
3. Conclusion and Q/A

Keynote Speaker:

Dr. Agustin Ochoa, developer of the dpi/sfg approach to analysis, is presently an independent consultant in analog design and author of 'Feedback in Analog Circuits' published this year by Springer Publishing

Company. He received his BSEE at the University of Arizona (1971), MSEE at Stanford University (1972), and returned to U of Arizona for his PhD (1977). Dr. Ochoa began his working career at Sandia National Laboratories doing device physics and IC technology development in radiation hardened CMOS until 1985, and then at Hughes Aircraft until 1990. At this time he left his senior device/technology work and joined the dark world of analog design as a junior apprentice analog engineer, but with a strong device and math supporting background. He quickly found that feedback was 'hard' (as told to him one day by Paul Brokow—of bandgap fame). Dr. Ochoa then began working on understanding feedback and developed the Driving Point Impedance/Signal Flow Graph (DPI/SFG) analysis technique combining Dr. Ruben Kelly's (University of New Mexico) 'Driving Point Impedance' approach with Dr. S. Mason's signal flow graphs. Dr. Ochoa has applied this approach to the design of general feedback systems including PLL's, Voltage Regulators, Switched Capacitor Filters, Crystal Oscillators, bandgap references, RFID front end, and other feedback subsystems. He has over 30 publications, has taught as an Adjunct Professor at the University of New Mexico and at the University of California at San Diego, and given seminars and short courses on his DPI/SFG approach widely. He has 7 patents granted and another 8 pending.

Luncheon/Meeting:

This Life Member Luncheon/Meeting is scheduled for Monday, May 23, 2016 at 11:30AM at Vittorio's located at 7875 Highland Village Place just off of Route 56 in San Diego. It is located about a block north of the Camino Del Sur exit. Highland Village Place is the 1st light from Route 56. Turn left onto Highland Village Place and turn immediately left (next light) into the shopping center and then immediately left and all the way to the end.

We have set up a special menu and room at 11:30AM. To help defray the cost of this Luncheon, we have set the cost to attend at $15 cash per person at the door. Please **RVSP by email to Bill Denke, wdenke1@san.rr.com by Friday, May 20th** so that we can make sure we have room for all. Please retract you RSVP if you find out that you cannot honor your RSVP, ASAP, so that we can honor our waiting list. Keep in mind that this is a Life Member Event and therefore we have limited room for regular San Diego Section Members.