Book Review: Analog Circuit Design: Discrete & Integrated

Steve Taranovich - December 30, 2014

Editor’s note: Professor Sergio Franco (retired) is an active author on EDN with his blog for Analog Bytes. I had also previously reviewed his other latest book on EDN: Design with Operational Amplifiers and Analog Integrated Circuits which is another excellent textbook. This time I am reviewing an undergraduate textbook that he has written that I believe is one of the best I have seen on the market today for engineering students as well as anyone interested in learning the basics of electronic design.

Analog Circuit Design: Discrete & Integrated

1st Edition

By Sergio Franco

- Copyright: 2015
- Publication Date: Jan 22 2014
- ISBN 10: 0078028191
I had met Professor Franco when I attended, for the first time, the Analog Aficionados dinner which Jim Williams had as an annual event in California. I was immediately drawn to him as I saw him surrounded by young analog engineers and engineering students also attending that dinner. The fledgling engineers were riveted to his cordial, but educational commentary on a technical design subject. His charismatic persona both educated and entertained at the same time.

His newest book, *Analog Circuit Design: Discrete and Integrated*, an EE undergraduate textbook, was a delightful read for me as I reminisced about my own undergraduate education at the NYU University Heights Engineering School in 1968. I had some of the best professors in engineering those years, like Sidney Shamus, a network analysis expert, but I do wish Professor Franco was one of my professors back then as well.

This textbook is structured with the typical basics at the beginning with diodes, the p-n junction, BJTs, and MOSFETs. We move on to the Analog IC building blocks, then the Analog IC, Frequency and Time response and finally Feedback, Stability and Noise.

The author recognizes that digital ICs use CMOS architectures most of the time, but analog ICs are not fading into the background. On the contrary, we live in an analog world that needs to be amplified, filtered and converted to a digital signal that can be processed by the microcontroller or DSP. Analog ICs are designed using CMSO and Bipolar/BiCMOS (for high-performance functions).

EE students need to first understand discrete design techniques, which is how the electronics industry first started 60 years ago. The next step that Professor France moves to is integrated design, which is of course how today’s analog ICs are constructed.

The chapters are more than 100 pages in length so that in-depth coverage is given for the student. I really like the book website which has a solutions manual and PowerPoint lecture slides with web links and errata—great for instructors. (My professors at NYU in 1968 would have loved this format!)

**An inherent balance of material**

There is an inherent balance of material enabling the student to both acquire the ability to design on-chip as well as to design on a circuit board. Students at this level (probably third year undergraduate) will most likely not yet know where they will be working or what aspect of electronics they may come to enjoy as an EE.

The inclusion of a plethora of design examples, like the ones with which EEs will likely be
challenged, will prepare the student for situations they will likely be challenged in their engineering work. I always found that the examples helped me to better understand the application of the theory and were only second to a good hands-on lab.

Franco gives the student a good feel for the order of magnitude of the quantities they will encounter in their design career. I really feel this is an important aspect of engineering that can be easily missed by some educational programs. Engineers really need to have an idea of roughly where the final answer/solution will fall—just a ballpark number. They will need to determine if they are far off the mark with their answer due to some error in calculation, so that they do not mistakenly go down that wrong path to the right solution and can return to their line of reasoning and find their error.

The systematic problem-solving method Franco introduces promotes the student thinking and physical intuition on the path to problem-solving because that’s the way we, as engineers, approach problems. Don’t jump into a computer simulation or calculation number-crunching without first having a feel for the region in which the answer should lie.

The rules-of-thumb that this book provides will be used frequently by the engineer and will remain as a part of the design process throughout their career.

SPICE simulations have been added in this textbook and it is understood that Franco intends the student to use this tool as a validation for paper calculations and not as a primary solution method. As a caveat, sometimes SPICE will need to be employed for a problem far too complex for a hand design estimation.

Many universities do not teach design methodology and a thinking style that follows a scientific and engineering design thought process. This textbook promotes this method of problem-solving that we, as engineers, use in our daily lives toward the solution of all problems encountered. The engineer will tailor this process to their own specific needs and method to meet their particular design approach.

I strongly advise new and seasoned engineers to put this book on your shelves in your office for you and your colleagues to reference from time to time.