Reader Feedback:

A Mailbag And Book Review

This month's column takes a look at the mail, plus a new edition of a popular op amp book. It's been a while since we've shared the mail with you in "Tools And Tips." In the interim, a variety of letters have crossed my desk, including some that focus on older columns.

E-mail Starter Kit (Feb. 3, 1997): This column had a carryover dialogue. Dave Bunin, of KBI Systems, had written to me last March with a special e-mail query. He sought an Internet-compatible e-mail system suitable for a small (<50 employees) company operating on a LAN. I didn't know of such a system, so I could only answer him in very general terms at the time.

More recently, Dave wrote back to tell me that he had indeed found a system which met his company's needs, namely a package called WIG (Workgroup Internet Gateway), from Sareen Software, P.O. Box 140029, Nashville, TN 37214; (615) 902-0000; or *www.sareen.com.*

This program allows users of a common workgroup to send/receive Internet e-mail via a Windows PC. One machine on the LAN requires an Internet connection, and it sends/receives messages to/from an ISP. WIG supports the widely used mail standards, such as the familiar SMTP and POP3 services, and both MIME and UUENCODE encoded attachments.

Also on e-mail, correspondents may have noted my use of new addresses, to segregate business and column mail. Past addresses are still valid, but *Walt_Jung@CSI.com* is preferred.

Analog's Shrinking World (April 1, 1997): In another carryover, consultant Wilton Helm wrote on surface-mount (SM) technology in analog designs.

Walt, glad to see your column in ELECTRONIC DESIGN. I got your op-amp cookbook many years ago (20, I think), and learned to appreciate your practical sense of engineering.

Since you asked twice now, I'll give a dissenting opinion on analog SM. I am a consultant doing hardware and software designs that range from control circuits through microwaves, often with embedded processors.

I disagree that SM is a bad thing for audio and analog in general. Sure it's a bit of a pain to prototype, and in some situations, harder to do thermal management in high-power situations. But, the high-frequency (HF) performance gains due to lowered parasitics makes it worth any pain.

For starters, op amps generally have wider, flatter response curves (same die) just because of less bond wire, lead frame inductance, and pin capacitance. That is even before putting them on a pc board. Add the wonders of 1206 resistors and capacitors, and it can make a real performance difference. And, general-purpose analog devices such as op amps now work in HF applications.

The first use of chip capacitors, resistors, and other SM devices was in RF devices, where parasitics couldn't be tolerated. Thankfully, miniaturization demands have now migrated these devices down, covering most solid-state parts.


WALT JUNG

As for prototyping pains, I learned many years ago not to breadboard or to wire wrap anything critical. Not only does prototype behavior differ so much from the finished product to be of minimal use, it's too expensive. I test what subcircuits I need, using prototype boards or pc-board material and a Dremel tool. Then, I build my first prototype on the computer using pc-board software, and have a few made. They may not be perfect—in fact, whole sections may need redoing—but the resulting cut and jumpered board mimics the finished product a lot more faithfully than any other prototype form I know.

As a bonus, I have a near-finished set of artwork on the computer awaiting final changes. The cost of making a few boards is about two days of engineering time, less than the cost of tacking something together or wire wrapping. CAD time is mostly recovered with the production artwork; with luck it is 90% done. Keep up the interesting columns.

Hi Wilton, thanks for your thoughts on the column. I'm glad that you find my *IC Op Amp Cookbook* practical.

I'm rather surprised that no one else has taken up my challenge regarding the analog merits of SM. But let's take your points on SM as part of a larger, overall analog design world picture.

Your perspective isn't really all that far from what I expressed in the Sept. 2, 1997 column, or the "good" side of SM active device performance. We both agree smaller packages are better here, and it has led to the use of relatively straightforward designs using op amps into the hundreds of MHz. This is something I'd never have thought possible 15 years ago.

But, if speed-related performance is all we want here, how about no package, like individual hybrid chips? This is the ultimate HF performance with multiple analog ICs. Perhaps you've been down that road as well. Even SOTs add parasitics vis-a-vis bare chips.

Unfortunately, analog isn't composed of just video and RF applications. There are still tons of lower-frequency applications that can be very demanding. But, with the current trends in packaging and IC developments, I don't necessarily see them continuing to be solved as well in the future—that is, as well as they are now using highly mature analog parts such as the OP07 series.

A trend accompanying SM packaging is lower system supplies, down to 3 V or less. This has already led to lowered maximum operating voltages, as smaller geometry and faster processes allow less $V_{S(MAX)}$ while producing the tiny parts you and others like. But suppose 10 years from now you need to handle a 120-dB dynamic range on a 3-V supply system. How hard do you think that would be, compared to today's world, using a ±15-V amplifier such as the AD797? Back to discretes? *What* size reduction?

The general point is that trends such as ever-descending size and supply voltage ultimately have a price. We are already quickly migrating to this point with 12-V or less devices. I don't know what performance we'll have left when 1- to 2-V supplies are standard!

The passive SM RC components with low HF parasitics aren't always best for nonlinearities. Or, if you use high-quality NPO ceramic chip caps for lowest ac errors, you are limited to about 0.01 µF in electrical size. That's a serious constraint if you need a low THD+N 100-Hz LP filter!

The breadboard issue is a very tough nut to crack, and you've evolved your way with prototypes. Good! This likely came after learning what you could and couldn't do. The bottom line is that you have a degree of confidence entering a new design, and a time budget estimate.

But, this scenario is of little help to someone much-less experienced, as he or she lacks the broad-based, real-world experiences which help you to gauge things beforehand. A new engineer has been taught Spice simulation, which as you likely know, can be both good and bad. For larger mixed-signal systems, simulation can be impossible without device models. And no simulation will be 100% accurate without detailed model information on the board-level parts and interconnections.

This leaves the general picture regarding breadboarding pretty much as I had stated in the column. It is difficult, but can be helped some by manufacturers' evaluation boards. In the long run, they will always be insufficient for specific customer uses, so good breadboards are now more important than ever.

These are just a few thoughts to bounce back to you and the readers, to stimulate further thinking and response. Thanks for the interest and taking the time to write.

Computer Tech Support (Aug. 4, 1997, Revisit Nov. 3, 1997): These columns drew the greatest amount of mail, indeed too much for this article. Look for a special column on this hot-button topic next month.

Practical Circuits for Quiet Audio Transmissions (Nov. 17, 1997 Analog Special): A couple of readers wrote with queries on instrumentation amps in general, but without specific relevance to circuits in the article. James Davis, currently engineer for Duke University radio station WXDU, related his 1968 war story of installing common-mode isolation steps taken with setting up the same station. Transformer isolation was indeed a requisite to handle this case!

TIP: Although the Nov. 17 article didn't go into any depth on special design requirements for RFI prevention and cures, this point certainly is (or should be) a priority, for any audio or precision dc circuit operating within RF fields.

Franklin Miller, president of Sescom Inc., 2100 Ward Dr., Henderson, NV 89015-4249; (702) 565-3400; or *www.sescom.com* was helpful both before and during the course of preparing the article. His company's products are worth mention for all-around utility. Not only do they make a broad line of audio transformers, they also provide off-the-shelf and custom audio chassis. They also make various items useful in electronic prototyping and breadboarding, not just for audio, but also for wideband circuits. One example is the PSB series, various-sized assemblies of copper-clad pc boards and metal side rails. When completed, these fit into a clean, RF-tight box suitable for housing small circuits, etc.

Op Amp Books: Reader mail on the column's various book reviews has been generally positive. That said, I'll also admit that I can hardly resist any new book on op amps, particularly when a new revision of a useful prior edition appears. Sergio Franco's revised textbook on op amps is now out, and I've had a chance to look it over. It is *Design with Operational Amplifiers and Analog Integrated Circuits, Second Edition*, ISBN 0-07-021857-9, 668 pages with index, from McGraw-Hill. There also is a dedicated web site located at *www.mhhe.com/engcs/electrical/franco/*. Note that Amazon.com lists it at $92.50, *www.amazon.com*.

One could say that this new edition is much like the first, which it is. But it is more up-to-date and expanded in some key areas. It also has very good general coverage of op amps and other analog applications, such as active filters. As a bonus, there is extended coverage on other popular analog and mixed-signal ICs, such as timers, VCOs and function generators, V/Fs, DACs and ADCs, switching regulators, and PLLs.

A chapter heading summary of the book is as follows: 1. Operational Amplifier Fundamentals, 2. Circuits with Resistive Feedback, 3. Active Filters: Part I, 4. Active Filters: Part II, 5. Static Op Amp Limitations, 6. Dynamic Op Amp Limitations, 7. Noise, 8. Stability, 9. Nonlinear Circuits, 10. Signal Generators, 11. Voltage References and Regulators, 12. D-A and A-D Converters, 13. Nonlinear Amplifiers and Phase-Locked Loops

This book is used in the author's senior EE course at San Francisco State University, Calif., and it has 176 worked examples and 526 challenging end-of-chapter problems, in classic textbook style. The difference between this book and some other textbooks is that this one is more attuned to current design practices.

This current interest is evident in the treatment given throughout the text, such as the use of Spice simulations and graphics, to demonstrate various points. There also are updated sections on modern op-amp designs, for example, the use of current-feedback amplifiers, as well as the voltage-feedback type. The active-filter portion of this book comprises two complete chapters, and is a remarkably clear and lucid presentation. It also is expanded, and includes standard and more-advanced topology filter types. Among these are compensated state-variable filters, popular Sallen-Key filters, GICs and FDNRs, switched-capacitor types, and sensitivity analysis, etc., as well as some advanced analysis techniques in filter design (the use of Laplace synthesis in conjunction with PSpice).

TIP: This new book is considerably improved over its previous edition, and could serve as a good general overview of op-amp and related analog theory for designers. While certainly not an applications manual, *Design with Operational Amplifiers and Analog Integrated Circuits*, strikes a balance between the purely theoretical and workable circuits, yet still retains the instructional guise of a textbook.

That's it for another column. Enjoy, and stay in touch.

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