The Filter Wizard
issue 1: Who, what and why?
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Welcome to Kendall's world of signals and circuit stuff! Courtesy of a too-good-to-turn-down offer from the Editor of Analog DesignLine Europe (hmmm, shouldn't that be Analogue?), I now have the great privilege, golden opportunity and daunting responsibility to 'entertrain' a wide constituency of hard-pressed electronics engineers with tips on some of the thornier recesses of signal processing. There's lots to talk about across many different domains and disciplines, and also the chance to lighten up your daily grind a little. But first, who am I?

Born grasping a soldering iron (hospitals, eh?), I've been making and breaking electronic things for over four decades. As a kid, old radios, televisions and record players provided a fertile ground for experimentation. Adolescence built on this with the construction of music synthesizers and music reproduction equipment of quite varying levels of 'fi'. On leaving school, convinced that a future in the hi-fi industry lay in store and keen to start earning some money before going up to Oxford to begin a Physics degree, I set out on a tour of local speaker and amplifier manufacturers. But I got no further than a small electronics company almost in my back yard; shelves and shelves of delicious electronic components, throbbing 'scope traces and a workforce that was encouraged to make their own equipment during the lunch-hour. It was too much to walk away from, and I ended up staying there 21 years.

Up at Oxford, the physics showed me how the stuff works; the guys who made balloon and satellite instrumentation taught me about making stuff that doesn't break, and the wonderful Dr Robinson further fired up my love of the junction FET (and my repertoire of questionable cocktails; his favourite was elderberry wine and gin; tutorials were *such* fun). This deep knowledge, and an early appreciation of the value of personal computers in electronic design, launched me into the great world of analogue circuits and signal processing.

Around eleven years ago, I made the poacher-to-gamekeeper transition and started working *within* the semiconductor industry, instead of being a vociferous, picky customer lobbing in difficult questions from outside. Already a great fan of their products, I ended up working for Burr-Brown, and subsequently for Texas Instruments after the merger. Then came an interesting diversion into ultra-low-power radio for hearing aids (where even the leakage current of a tantalum capacitor needs to be accounted for).

And now it's present day and I'm at Cypress Semiconductor, striving to achieve great things in the mixed-signal microcontroller space, which was non-existent in my formative years. With analogue signal conditioning, high quality conversion to digital and tons of on-chip compute power working together in harmony, great systems can be constructed at cost levels I could only dream of in my younger years.

So, what might my columnar outpourings, and the design notes that may spin out from them, be able to contribute to your professional life? Well, three decades of chasing down signals, extracting them from the mire and hustling them through many different domains for my company and for my customers, provides a large chunk of accumulated experience, and I'd like to share it with you in this regular column.

In my work over the years, *filters* have always been close by, and I'd like to spend quite a lot of time on these old friends. The filtering function appears as a block in so many system diagrams; for various reasons, it seems to be feared and misunderstood in equal measure. Occasionally the villagers rise up and go charging against this monster with pitchforks raised, trying to drive it out of town. But the filter has an enduring role in the electronic ecosystem; I see it more as a lovable 'Shrek'-type ogre than as Dr Frankenstein's aggregate of mismatched body parts – though that description certainly fits some of the designs I've seen in my time helping applications guys.

Here are some filter questions which come up again and again: What are filters *for*? What do filters *do*? Which way should I implement my filters? Should I do it 'analogue' or 'digital', or some hybrid approach? What's the risk that adding circuitry will make things *worse*, not better? And, inevitably, each of these major branches launches a thousand tendrils of enquiry: How much current will it take? How to handle high voltages? Do I need a fast op-amp? How do I make a million of them, all the same, without tuning them? And small? And cheap? And so on. Over the coming months, I'll try to address these questions; weaving something for you that's part safety-net and part coat-of-many-colours; part tutorial and part therapy (though for whom is not yet clear..).

I'm hoping for good interaction as well; with luck, the web infrastructure wizards in the DesignLine network will find a way of getting your questions and comments to me. And I'll probably not be able to resist having a joust at some of the things which appear on the web in the guise of valuable analogue insight – there are a lot of red rags out there. For instance, the idea that a CD containing *properly converted* audio material can make the DAC's output filter ring in such a way that 'energy is smeared over time'. Oh well, I'm going to have to make *some* people unhappy, aren't I? Until next time – Kendall.