

## DID MASSENBURG *REALLY* INVENT THE [PARAMETRIC EQ](#)?

Thanks for the opportunity to document the early days of the Parametric EQ. In fact, the question of "...how much of the modern-day 4 op-amp state-variable-filter-based parametric EQ..." I designed is answerable: little...sort-of. Our topologies were and are invariably based on single-opamp designs based on "T" filters. I did in fact coin the term "parametric" and published the first description of the device in a [1972 AES preprint](#), which is still available. Burgess Macneal might wish to be heard on this as well, but I think the following is pretty accurate.

In my informed opinion only four people could possibly lay claim to the modern concept: Bob Meushaw, Burgess Macneal, Daniel Flickinger, and myself; I don't know Dan, and I understand that he's (wisely, perhaps) been out of audio since somewhere around the time of the Ike Turner/Bolic Sound debacle.

Our (Bob's, Burgess' and my) [sweep-tunable EQ](#) was borne, more or less, out of a idea that Burgess and I had around 1966 or 1967 for an EQ that would avoid inductors and switches, both expensive and seemingly-flawed items in that day. In 1964 or 65 we had built a console for Recordings Incorporated of Baltimore that utilized the first Fairchild monolithic IC's, both 709's and 716's. The performance was woefully inadequate, and our later designs were built around discrete-transistor op-amps.

Somewhere around 1967, Bob Meushaw (an old friend of mine from Poly, who went on to Princeton and has since disappeared into the anonymity of the National Security Agency) built a three-band, frequency-adjustable, fixed-Q, IC op-amp-based EQ based on passive 2 resistor/2 capacitor or 3 resistor/3 capacitor "T" filters - a design basically taken out of a 1940's Bell Labs filter handbook. The user interface was embryonic - boosts and cuts were done by independent controls - and the high-end EQ was a wierd, three-pole "T filter". The performance was flawed - the op-amps were really noisy and the three-pole HF section had a overly-sharp, asymmetrical bell-curve. But in 1968 I started doing recordings using this prototype, and started discovering advantages of using it rather than the available EQ's of the day: Fairchild console modules, Altec graphic EQ's, and Lang or Cinema Engineering program EQ's.

By 1969 I was spending all of my time designing circuitry sufficient to get to an elegant user interface: we perceived this as three controls adjusting, independently, the parameters for each of three bands for a recording console. This console was for ITI, which had absorbed Recordings Incorporated, and the device was by no means the *raison d'etre* for ITI. It's pathetically intelligence-challenged chief exec, Jack Best, imagined himself to be a visionary captain of industry (Jack had slipped some cash to Spiro Agnew - remember him? - in trade for a position on the CAB), and was producing and distributing business programs on cassette. He needed studios with consoles, and I had an opportunity. I remember agonizing over the topology for the EQ for months, and

asking everyone I knew for help. One person comes to mind: there was a well-known engineer working next door at Aircraft Armaments who looked at the goals and stated that he felt that the circuit solution was impossible or impractical. His name was Walt Jung and he went on to write the "IC OpAmp Cookbook" a few years later.

Incidentally, during that time I was taking Electrical Engineering at Johns Hopkins University, a school that was as medieval, apathetic and oppressive as schooling in the 60's could get. I got into a row with a 'professor', who looked at a schematic for a gyrator that we had built and declared it "of theoretical interest only", and "impractical" to implement. Seeing this as a sign, I dropped out of college.

The first and only ITI console (which later sank into the cold depths of the Baltimore harbor, but that's another story), and then the ME-230 Parametric EQ, used a discrete op-amp, which was designed by Chick Sauter, a video electronics design engineer, from whom I learn much. This discrete op-amp had 2N4250A PNP inputs and MPSU06/56 outputs, and at least two \*more\* gain stages inbetween, and was not particularly stable. But was magnitudes quieter than the available IC's of the day, and had at least 6 or 8dB more headroom due to the higher (+/- 28v) rails. Certain Los Angeles engineers (Rik Pekonnen / Allen Sides) still think that this was the cleanest EQ I've ever built. I think they've been smoking something.

I remember the ITI console being finished sometime in 1969 (although I may be off a year), and I did alot of recording on it, although I don't remember anything we did finding a large market. Also, our choice of a Beyer input transformer limited the low-end performance, so it wasn't particularly a "hi-fi" console. But I was certainly doing recording with it long before I saw my first Flickinger console at the New York AES in 1971, the show at which we introduced the ME-230. I remember little from that show save comments such as, "where are the click-stops?" Deane Jensen (my childhood neighbor and friend) took pictures of the console around this time, but God knows what happened to them.

I wrote and delivered the [AES paper](#) on Parametrics at the Los Angeles show in 1972 (I'd be delighted to forward a PDF of it to anyone who's interested). Two things of note. First, it's the first mention of "Parametric" associated with [sweep-tunable EQ](#). Second, we missed the submission deadline and Burgess and I type-set (on an early IBM typesetter) and printed the pre-prints ourselves (we had a process darkroom and printing plant for record labels and jackets), under the guidelines of the AES; there's a Chemco exposure control strip on the final paper. We never thought of patenting or copyrighting anything; Jack Best couldn't claim the slightest use to anything I was doing.

Several things come to mind from that period:

I met a brilliant engineer, David Blackmer, at the session at which I delivered the first paper; he was delivering one of his early papers on either his VCA (which changed the industry) or noise-reduction (which was somewhat flawed compared to Ray Dolby's). I came away from the chance encounter and spent the next four or five years digging to

dynamics controllers, inspired by Blackmer's work, mostly for API at that time.

The first commercial parametric sold was to Gerhard Lehner of Barclay Studios in Paris (where I would later work after moving there in 1973).

Some years later I came to the aid of...was it Bill Thompson of Ashley Audio? Ray Dolby's attorneys were trying to "mine" the Dolby circuit patents and levy a fee of...geez what was it? 5c per band for a 1/3rd octave EQ's? I had previously implemented the circuit that Dolby engineers had patented in 1976; it is fundamental in the implementation of "reciprocal" curves. Luckily, it was described in an ITI manual which predated Dolby's patent, thus establishing "prior art".

After I moved to Los Angeles in 1975 I redesigned the basic discrete op-amp. For all of the GML and Sontec designs (Burgess and I, among others, own the company jointly, though you'd never know it) I designed two significant revisions. The first had truly stupendous HF response; it featured a 2N5566 dual J-FET running at an ungodly high current, and a highly-linear second stage which featured the dominant pole. It was ridiculously fast (150mHz gain-bandwidth, 600v/us slew rate) and stable (no instability over a 60dB gain-variation range) as it was unreliable (from smoking to out-and-out explosions). We've long since gone to a fast, very-high-gain NPN input stage, keeping the high-voltage gain 2nd stage for GML designs, although the design evolves as semiconductor manufacturers obsolete discrete parts.

Finally, what I'm proudest of is less in designing devices alone, and more in exploring the ever-expanding applications and uses of gear, and then applying that knowledge to designs.

**George Massenburg**