Canadian Audiologist

The Official Publication of the Canadian Academy of Audiology

Adaptive Compression – The Inside Story

Published April 17th, 2014

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Adaptive Compression, or AC for short, was a trade name of Telex Hearing Aids and was ubiquitous, under license, in many hearing aid circuitry in the late 1980s and early 1990s. The name was kind of sexy, but did not really describe it. Actually, it was a *dual-time constant compression circuit with adaptive characteristics*, but who would ever pay attention to something that cumbersome?

Originally we looked for a solution to the mildly irritating phenomenon of “pumping,” where the background noise comes rushing back up after a sentence, or the speaker pauses.

Our circuit (David Hotvet was the inventor) eliminated that issue. However, its unexpected interaction with speech elements turned out to be an improvement over the usual single-time-constant compression circuit of the day.

Summarized, the usual compression time constants were comparable with the time elements of speech and a “fast pumping” phenomenon caused fill-in of noise between the syllabic elements. This reduced the instantaneous signal-to-noise ratio of the amplified speech. The short-time-constant part of AC reacted fast enough to eliminate this fast pumping, and retained most of the instantaneous SNR. This resulted in at least some improvement in amplified speech in noisy conditions.

The original circuit was built with two LTI IC's (LTI became Gennum, and later, Sound Design. This is now part of ON-Semiconductor). That was fine for the larger behind the ear hearing aids, but too big for the smaller custom hearing aids, which were becoming the dominant style.

I had talked to Bill Cole at some show and found he was interested in taking on a custom IC design project, like he had been doing at LTI. Fortunately I had enough sense to grab this opportunity and talk our management into contracting Bill for a custom AC chip.

Art Johnson worked with Bill from our end. Both of them were talented circuit designers, and it was a tough task, with weird circuit problems peculiar to the AC feature. Eventually we had a custom chip (made by LTI) and it served us well for years. I was very lucky to have a number of people work with me that were a lot smarter than I was, I only had to be the cheerleader

The investigation and discoveries of the peculiarities of AC were all done in our lab, but Telex did not have the resources for clinical testing. We did convince Mead Killion at Etymotic Research of the uniqueness of AC and he incorporated it in his K-Amp under license. Helpfully, one of his PhD students (Selda Fikret-Pasa) was able to show evidence of improved performance in her research for her PhD thesis.

Another unusual effect was apparent when we listened to the AC-processed speech: an audible increase in higher-frequency components. We called this the “stage whisper” effect. It was not a major aspect, but it did seem to accentuate sibilants somewhat and *seemed* to improve

intelligibility.

Darrell Rose, head of audiology at Mayo Clinic in Rochester MN, thought well of our technology, and invited me to present at the Mayo Audiology Video Conference in 1993. I must say that was a highlight of my professional career. A somewhat embarrassing consequence was that my name was thereafter often accompanied by the letters PhD when referenced in literature. Why? I was the *only* one of the presenters without a doctorate, so editors must have thought they were correcting an obvious error. Well, I was flattered, anyway.

After I retired in 1994, my successor at Telex, Tom Scheller, received two patents dealing with AC, so I suppose some efforts were being made to develop the concept further. It was not enough to satisfy management, and Telex disbanded and sold its hearing aid business. Hearing aids were going digital which was a huge change, overshadowing the relatively low-level benefits of our compression focused on the timing of speech elements.