Contribution ID: **194** Type: **Oral**

It is Time to use Time (for Digital RF Clock Generation and Time-of-Flight)

Wednesday, 19 September 2018 15:45 (45 minutes)

Unlike today when "digital turns into analog"and "analog turns into digital", back in the late 1990s, the separation between analog and digital was unmistakable and vast. The design techniques, automation flow (or the lack of it), or even the way of designers' thinking were simply incompatible. Probably the only major area that was blurring these boundaries was a read channel for magnetic recording in hard disk drives. It employed precise continuous-time filtering combined with ultra-high speed discrete time analog signal processing plus sophisticated digital processing. Having been fully immersed in that way of thinking and then moving to an RF group within Texas Instruments has produced an eye-opening experience. The read channel was sampling at 750MS/s and GSM then was only 900MHz so the CMOS technology was becoming fast enough. Why not exploit the digital and sampling techniques to directly digitize the RF signal? Of course, doing so blindly would burn too much power to make it practical but why not exploit another idea of magnetic recording: time-domain information? The information has traditionally been encoded as voltage (or sometimes current), but why not use time? This immediately led to the idea of time-to-digital converters (TDC) to solve the pesky problem of phase error filtering in PLLs. When a digitally controlled oscillator (DCO) was added to it, the resulting ADPLL is just the history.

Summary

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Session Classification: Invited