

## ~ Keynote Speaker ~

*Professor Fredric J Harris*

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**Title:** Green Technology Filters Applied DSP Magic: Cascade Polyphase Filter Banks



### **Abstract:**

A polyphaser filter bank comes in two contrasting forms. One does analysis and one does synthesis. These are opposite things. One partitions a broadband input signal into  $M$  narrow band baseband output signals. The other assembles a broadband output signal from  $M$  narrow band baseband input signals. What's impressive is that they each accomplish their tasks with a single filter: not  $M$  copies of that filter, but one single filter. The second surprise is that they do a counter-intuitive thing: they move spectral bands by aliasing them to and from baseband and then separate the multiple aliases. In this magic land, aliasing is your friend. Have we gotten your attention? We then do something silly. To accomplish truly remarkable feats of signal processing, we cascade a pair of analysis and synthesis filter banks. One of the things we can now do is form variable bandwidth filters without changing filter coefficients and we do this with an order of magnitude reduction in processing costs relative to their direct implementation. We can also convert a 3-GHz sample rate input data stream into 60 parallel 100 MHz output data streams for processing with reduced cost, lower speed DSP processors. While at it we show how the same process can form multiple simultaneous baseband filters with arbitrary bandwidths and center frequencies with similarly impressive reductions in processing cost. And then we stop because our minds can only absorb a limited number of things that appear to be too good to be true.

## **Biography:**

Professor harris is at the University of California San Diego where he teaches and conducts research on Digital Signal Processing and Communication Systems. He holds 40 patents on digital receiver and DSP technology and lectures throughout the world on DSP applications. He consults for organizations requiring high performance, cost effective DSP solutions.

He has written some 260 journal and conference papers, the most well-known being his 1978 paper "On the use of Windows for Harmonic Analysis with the Discrete Fourier Transform". He is the author of the book Multirate Signal Processing for Communication Systems and has contributed to several other DSP books. His special areas include Polyphase Filter Banks, Physical Layer Modem design, and Synchronizing Digital Modems.

He was the Technical and General Chair respectively of the 1990 and 1991 Asilomar Conference on Signals, Systems, and Computers, was Technical Chair of the 2003 Software Defined Radio Conference, of the 2006 Wireless Personal Multimedia Conference, of the DSP-2009, DSP-2013 Conferences and of the SDR-WinnComm 2015 Conference. He became a Fellow of the IEEE in 2003, cited for contributions of DSP to communications systems. In 2006 he received the Software Defined Radio Forum's "Industry Achievement Award". He recently received the DSP-2018 conference's commemorative plaque with the citation: We wish to recognize and pay tribute to fred harris for his pioneering contributions to digital signal processing algorithmic design and implementation, and his visionary and distinguished service to the Signal Processing Community.

The spelling of his name with all lower case letters is a source of distress for typists and spell checkers. A child at heart, he collects toy trains and old slide-rules.