



Department of Electrical and Computer Eng. Colloquium

Cochlea-inspired RF and Microwave Channelizing Filters for Wideband Communications Systems

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260 Dreesse Lab

Multiplexers with a large number of output ports—called channelizers—have always posed a challenging design problem. Standard multiplexer designs use a set of channel filters connected by a manifold consisting of transmission lines (or waveguide) and tuning elements between separate channel filters. Waveguide-based solutions require extensive manual tuning and are bulky and expensive, but offer excellent performance.

We have approached the problem of designing wide bandwidth, contiguous-channel, multiplexing filters by implementing a model of the mammalian cochlea. The cochlea is an amazing channelizing filter, covering three decades of bandwidth with over 3,000 channels in a very small physical space. Using a simplified mechanical cochlear model and its electrical analogue, we have developed RF and microwave channelizers that retain the desirable features of the cochlea including multiple-octave frequency coverage, a large number of output channels, and an enhanced, high-order upper stop-band response.

Versions are presented that cover 20-90 MHz, with both constant fractional bandwidth and constant absolute bandwidth channels, planar microwave channelizers covering 2-7 GHz, and higher-order cochlea-like channelizers covering 200 MHz to 1 GHz. Applications of these channelizing filters include wideband, contiguous-channel receivers for signal intelligence or spectral analysis.

Bio: Chris Galbraith received the B.S.E.E. and M.S.E.E. degrees from The University of Michigan in 2002 and 2004, where is currently a Ph.D. candidate. His interests include wideband integrated microwave circuit design, microwave filters, and antennas. During the summers of 2002 and 2003 he developed W-band receiver front-ends and studied communications satellite systems at TRW Space and Electronics.