Filter Bank – Based Multicarrier Modulation

Even though we do have on going research on traditional OFDM/DMT techniques, part of our research in multicarrier communication concentrates on filter bank-based multicarrier modulation. We refer to this as cosine-modulated filter bank multicarrier modulation (CMFB-MCM) or cosine-modulated multitone (CMT), for a shorter terminology. In the past, under the name discrete wavelet multitone (DWMT) modulation, CMT has been considered for data transmission over digital subscriber lines (DSL). We propose a new receiver structure that is different from those proposed in the previous publications. The new structure simplifies the task of channel equalization, by reducing the number of equalizer parameters by an order of magnitude. We also propose a novel blind equalization algorithm that fits very nicely in the proposed structure. Moreover, we discuss bandwidth efficiency of the proposed CMT and show that it is superior to the convention (single carrier) quadrature amplitude modulation (QAM) and OFDM/CMT. The CMFB is found to be a signal processing block that stacks a number of vestigial sideband (VSB) modulated signals in a number of overlapping subchannels in the most efficient way. We have compared the CMFB-MCM/CMT with OFDM/DMT and shown that the former has a number of advantages over the latter. The details of these comparisons can be found in:


An analysis of DWMT that has led to the development of CMFB-MCM/CMT is presented in:


See the next two pages for examples of performance of CMFB-MCM/CMT compared to OFDM/DMT.
Example 1:
Fig. 10 of the first paper above shows the bit-error-rate (BER) results of CMFB-MCMC and OFDM in a wireless channel.

Fig. 10. Bit-error-rate results of CMFB-MCM and OFDM for different block lengths. The length of cyclic prefix in OFDM is about one tenth of the block length. Each BER point is based on observation of 2000 or more bit errors. The CMFB-MCM and OFDM block lengths are, respectively, (a) 64 and 32; (b) 128 and 64; (c) 256 and 128; (d) 512 and 256.
Example 2:
Fig. 7 of the second paper above (presented below) compares the achievable bit rates of DMT, zipper DMT (z-DMT; a proposed method in the VDSL draft standard), filtered multitone (FMT; another proposed method in the VDSL draft standard), and CMT. CMT results are shown for two prototype filter designs; one based on perfect reconstruction (PR) design and one based on a near perfect reconstruction design, proposed in the paper. Upper bound shows the result that would be obtained if there was no intersymbol and intercarrier interference.