Design of a Filter Bank for Analog-digital Synthesis

Discrete-time (digital) filter banks are used in several application areas spanning signal processing, modulation, multiplexing, recognition, and so forth. Synthesis filter banks are capable of synthesizing a full band signal from its spectral subbands. Therefore, we propose to use such filter banks to synthesize a signal that is decomposed into several spectral bands in continuous-time (analog) domain.

The problem at hand is that of digital synthesis of signal received by an analog filter bank. Each filtered signal is sampled by an ADC. The analog filter bank comprises a series of filters whose frequency response in combination will span the bandwidth of the signal of interest, but in isolation, each analog filter will only cover a portion of the signal's bandwidth and may have different amplitude and phase response. Since the sampling and ADC processes are not precise, a model of the filters will be constructed. This model will then be used to design a discrete-time filter bank that minimizes the reconstruction error of the signal (and, in the best case, provide lossless reconstruction). Performance of the filter bank will then be evaluated against simulated and real data.