Audio Coding - Practice Lessons

Seminar 3

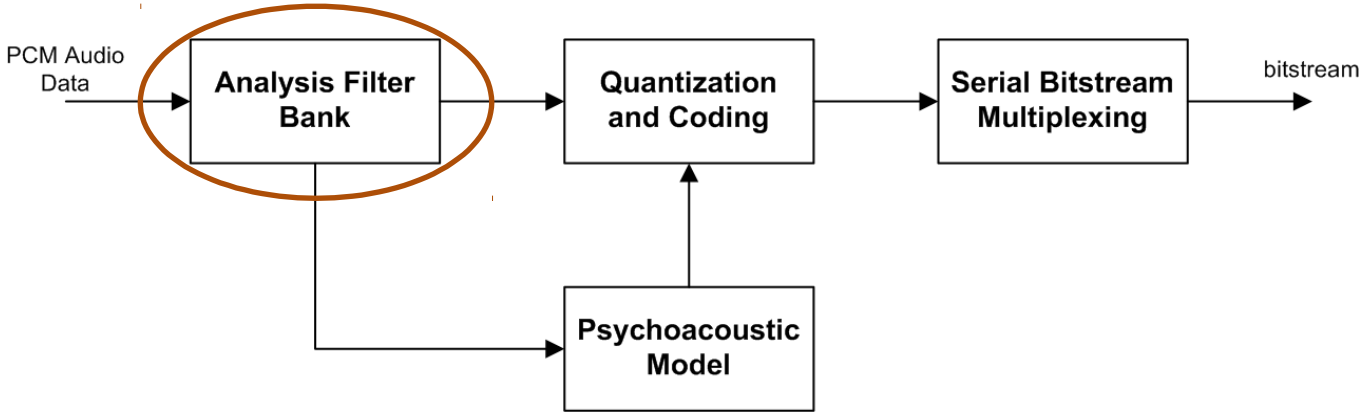
MDCT Filterbank

Homework Assignment 3

Goal:

- Subband analysis and synthesis of an audio signal
  → achieve perfect reconstruction (recover input signal perfectly, but with a delay)
- How to achieve that:
  Implement the MDCT via polyphase description

  → Lecture: FilterBanks 1



Homework Assignment 3

Task 1:

- Use the **direct implementation of the MDCT** analysis and synthesis filter bank with N=512 subbands, using its definition of the impulse response and downsamplers after the analysis filters and upsamplers before the synthesis filter bank
- Hint 1:
  Have a look at the lectures *Basics of Multirate Signal Processing*, *FilterBanks 1* & *2* and the lecture slides of *Multirate Signal Processing,* if necessary
- Hint 2 – MDCT: „modulated filter“ is described by following function $h_k(L-1-n)=h(n)\cdot\cos\left(\frac{\pi}{N}\cdot\left(k+\frac{1}{2}\right)\left(n+\frac{1}{2}-\frac{N}{2}\right)\right)$, where „window“ function

  $h(n)$ is $h(n)=\sin\left(\frac{\pi}{2N}(n+0.5)\right)$, for *n=0,...,2N-1* (see also: lecture 3).

Homework Assignment 3

Task 3:

- Test perfect reconstruction with a ramp function

  - plot original signal on top of reconstructed
  → is it reconstructed after the synthesis filter bank?

Task 4:

- Test the filterbank with an audio signal (mono signal)
- Plot 1-st and the last subband signal in the same plot
- Plot original and reconstructed signals on top of each other

For plots: title, axis names and legend are required