Audio Coding - Practice Lessons

Seminar 2

Polyphase MDCT Filterbank

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Audio Coding - Practice Lessons

General information

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Website:
http://www.tu-ilmenau.de/mt/lehrveranstaltungen/lehre-fuer-master-mt/audio-coding/

Moodle: moodle2.tu-ilmenau.de

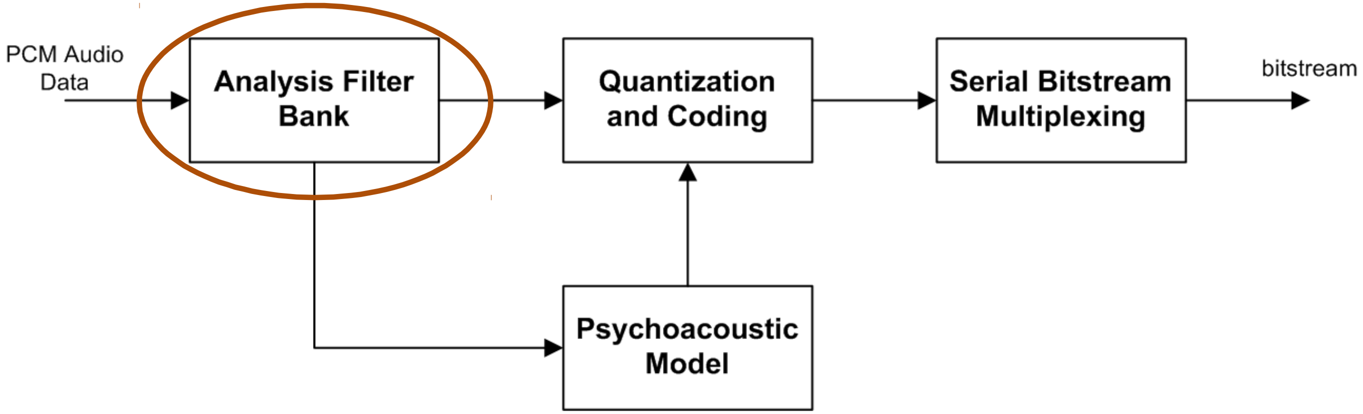
- Check for updates
- News (schedule changes, etc.)
- Homework tasks
- Lecture slides

Homework Assignment 2

<u>Goal</u>:

- 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



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Homework Assignment 2

Task 1:

- Use the **direct implementation of the MDCT** analysis and synthesis filter bank with N=128 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).

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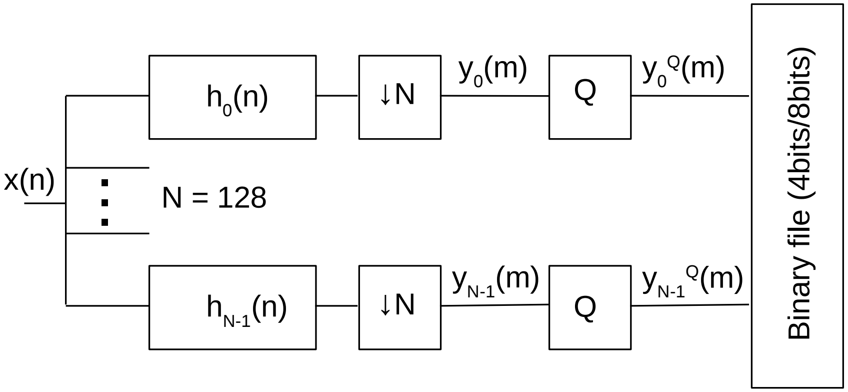
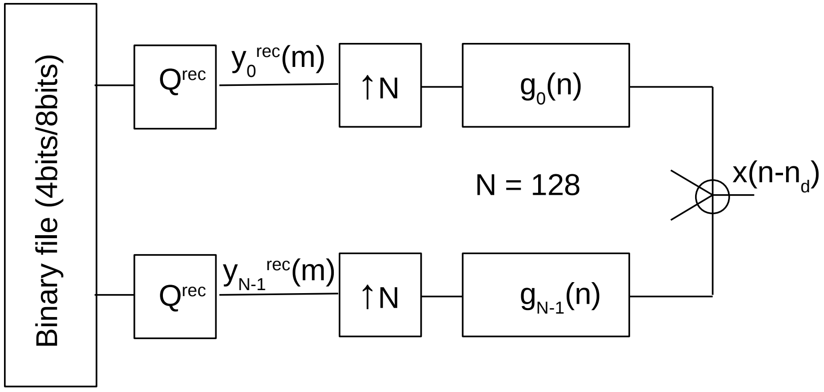
Homework Assignment 2

Task 2:

- Use your implementation from the first seminar to quantize each subband. Define your quantization steps in order to match the amplitude range of your subband.
- Quantize your subband with both 8bit and 4bit

Homework Assignment 2





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Homework Assignment 2

Task 3:

- Test perfect reconstruction with a ramp function
  → is it reconstructed after the synthesis filter bank?
- Compare 8bit and 4bit quantization with original 16bit quantization

Task 4:

- Test the filter impulse responses by inputting a 1 followed by zeros as input to one synthesis filter in the synthesis filter bank
- Does it look okay?
- Check its frequency response with freqz()
- Again: compare quantizations

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