Audio- / Videosignalverarbeitung
Advanced Digital Signal Processing
Digital Signal Processing 2

Seminar 1

WS 2014/2015

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Organization

- Wednesday (even weeks), 13:00-14:30pm (K 2003B)

- Tuesday (even weeks), 11:00-12:30pm (HU 210)

- Thursday (odd weeks), 09:00-10:30am (K 2026)

http://www.tu-ilmenau.de/it-dsv/lv/it-dsvlehre

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General information (1)

a) Homework assignments:

- Every two weeks (5-6 in total)
    - Solve with Matlab, Octave or Python Pylab
    - Can be done in groups of **max 3** people
    - Show and explain your solution in seminars
        - You can show a homework **only** during the seminar
        - Bring your laptop if it is possible, otherwise an USB stick
        - Submission via email is not possible

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General information (2)

b) Quiz

- One weekly quiz
- Test related to the latest content of the lecture
- Sign in at moodle2 (https://moodle2.tu-ilmenau.de/)
- Pass the Quiz until the next lecture
- **Deadlines** will be announced in moodle

General information (3)

- The homework points account for 30% of the final grade. The exam accounts for the other 70%.

- Real example:
  - With the 98% for seminars and a good grade in the exam you get 1.0
  - With the 0% for seminars and still a good grade in the exam you would get 2.7

- Gained points will only be added after passing the exam.

Matlab / Octave

- **QtOctave – installation guide available on moodle**
  - http://www.malinc.se/math/octave/mainen.php (Windows and Mac)
  - Graphical user interface for Octave
  - Freeware
  - Includes a tutorial
  - Apart from some syntax differences almost the same as Matlab
- **Matlab**
  - for those who have it
  - or use it at the computers at the UniRZ
  - Tutorial will be available on moodle2
- **Python Pylab**
  - Open source
  - http://ipython.org/install.html
- **Helpful links:**
  - http://www.mathworks.de/help/techdoc/
  - http://www.gomatlab.de/ (german)

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Homework assignment (1/3)

1. Generate 3 different signals
   – Use full and 20 dB under full range signals
   a) Triangular wave
   b) Sinusoidal wave
      • normalized Frequency of 0.1
      • $freq_{norm} = \frac{f}{f_s}$, where f- frequency of the signal and f_s-sampling frequency
      • Range = -1 to 1
   c) Any audio signal (16 bit)
      • You can download a file from our moodle page
      • Duration of the file ≤ 10 s
      • For reading a file into Matlab use *wavread(„name.wav")*
   → Plot and listen to the signals
   → <mark>What is the difference between full and under full range signals?</mark>

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Homework assignment (2/3)

2. Quantize and reconstruct signals
   – Uniform quantization with 16 bit accuracy
     • Implement Mid-tread and Mid-rise quantizers
     • <mark>Calculate the quantization error for both of them</mark>
     • <mark>Which one is better and why?</mark>
   – μ-law quantization with 8 bit accuracy

     $$y = sign(x) \cdot \frac{\ln(1+255 \cdot |\frac{x}{A}|)}{\ln(1+255)}$$

     $$x = sign(y) \cdot \frac{(256^{|y|}-1)}{255} \cdot A$$

→ <mark>Plot and listen to the signals</mark>

→ <mark>Compare results of uniform and μ-law quantization</mark>

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Homework assignment (3/3)

3. Determine SNR for all the signals. SNR should be calculated in dB.

$$SNR = 10 * log_{10}(\frac{Signal\ Energy}{Quantization\ Error\ Energy})$$

→ What stands out when comparing the SNRs of the sinusoidal and the triangular wave?

→ Please, use *subplot()* for making the plots

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