WHAT TO READ FOR THE EXAM OF DIGITAL LINEAR FILTERING II?

I. DIRECT-FORM FIR FILTERS

(a) What are the key ideas behind various design techniques, which are included in the course "Digital Linear Filtering I" and in the present one, for the design of linear-phase FIR filters?

(b) Advantages and drawbacks of these techniques; Comparison between these techniques in terms of flexibilities for generating linear-phase FIR with the desired properties; When is it advantageous to select only one out of the many optional techniques as the best candidate?

(c) For linear-phase FIR filters designed in the minimax sense, the lecture notes contain altogether three simple ways of converting a narrow-band prototype filter transfer function into another one. What are these simple ways?

(d) How to design low-pass minimum-phase FIR filters in a simple manner?

(e) What are Lth-band linear-phase FIR filters?; How to design a half-band linear-phase FIR filter using a "trick" used in the lecture notes?

II. SYNTHESIS OF LINEAR-PHASE FIR FILTERS USING PERIODIC FILTERS AS BUILDING BLOCKS

(f) What are the main benefits (and minor drawbacks) of using a transfer function of the form $F(z^L)$ as a building block in the synthesis schemes proposed in the lecture notes?

(g) The key idea behind the frequency-response masking approach.

(h) Forget the overall Jing-Fam approach! What are the key ideas of using a periodic subfilter, that is, the transfer function is of the form $F(z^L)$, when constructing a narrow-band or a wide-band linear-phase FIR filter?

III. IIR FILTERS

(i) Concentrate on the main lecture notes telling on how to construct a low-pass–high-pass or a band-pass–high-pass filter pair as a parallel connection of two all-pass filters.

(j) What are the block diagrams for these pairs?; What are the order differences in the above-mentioned two cases?; How the phase responses of the two all-pass filters should behave in order to arrive at the desired filter pairs?; What are the benefits of implementing the desired filter pair in the above-described manners compared to other implementation options?

IV. FINITE WORD-LENGTH EFFECTS

(k) What are the commonly used scaling norms for fixed-point arithmetic, especially for 2's complement arithmetic (basic definitions)?

(l) How do they differ from each other in terms of the probability of overflows and output noise variance due to the multiplication round-off errors.

(m) Very likely there is a question concerning the implementation of a sixth-order filter that is considered in Part 5 of the course "Digital Linear Filtering I" in pages 45–68 as well as in pages 77–78. The lecturer feels that this study case is very illustrative.

In summary, the lecture feels that the course outcomes, according to the up-dated way of describing courses, are met provided that you are pretty aware of the above-mentioned requirements. O tempora o mores – Both courses on digital linear filtering were produced by the lecturer fifteen years ago. The learning and the needs of the students have been changed a lot during this time slot. **Therefore, the lecture is eagerly waiting feedback on how to update these two courses to be as satisfactory to you as they were fifteen years ago. Please send an e-mail to ts@cs.tut.fi. That's all folks! Good luck for the exam and please study intensively! Your lecturer following basically the name Tapio, but, thanks to my international friends, there are variations as Tap, Tap(10), TOP10. Nowadays, the best one seems to be Tap_Top10.**