CCITT SGXV
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Experts Group for ATM Video Coding

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Title : Conversion filter for producing SCIF.
Purpose: Information

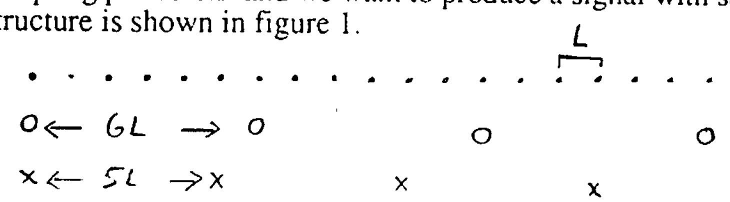
Introduction.

For the definition of a common format to be used for high quality communicational video services (for instance SCIF), a satisfactory solution to the conversion between the existing formats and SCIF has to be found.
This document defines a conversion filter to transform (60 Hz/525 line) or (50 Hz/625 line) signals to SCIF - 60 Hz/625 lines progressive. The filter is simple (has few taps) and seems to give little distortion in the produced SCIF format pictures.
It is hoped that other labs could use the same filter on a variety of picture material to see if it might be used as a solution to the conversion between existing formats and SCIF.

Definition of the filter.

We have a sampled signal - 50 Hz in time or 525 lines in vertical direction - that we want to "upsample" by a factor 6/5 to get 60 Hz or 625 lines. (The proposed filter can do either of the two conversions).

The definition of the filter is referred to a sampling period L. The input signal is sampled with sampling period 6L and we want to produce a signal with sampling period 5L. The sampling structure is shown in figure 1.



. basis for filter definition
o input signal
x output signal

Figure 1. Sampling structure.

The frequency response of a transversal symmetric filter with (N+1) taps may be given as:

$$H(\Omega) = h(0) + \sum_{n=1}^{N} h(n)\cdot\cos(nL\Omega)$$

with a sampling period of kL there will be repeats at: $\Omega = m\cdot(2\pi/kL)$, $m=1,2.....$
This means that the "useful" part of the spectrum - to avoid aliasing - is up to $\Omega = \pi/kL$.

In our case where the input signal has a sampling period of 6L we want to preserve as much of the signal as possible up to $\Omega = \pi/6L$. Moreover it is desirable that $H(\Omega)$ is zero at the repeats for 5L and 6L sampling: $2\pi/5L$ and $2\pi/6L$. I have defined a filter with N=8. The frequency response is shown in figure 2.

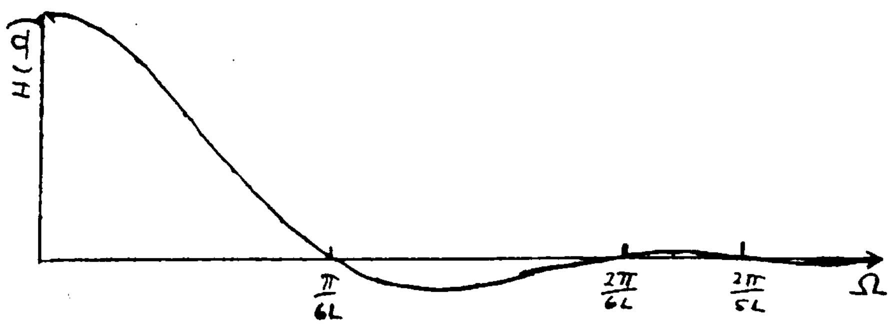


Figure 2. Frequency response of the filter defined by:.h(n)=10,10,10,10,9,7,5,3,1 n=0,8.

Using the filter.

When using the filter on a downsampled input signal, zero is put in the positions where samples are missing. This results in the following combinations of taps of the input signal:

(5,10,15/20, (7,10,3)/20, (9,10,1)/20, (10,10)/20.

The input signal is interlaced. The taps used is therefore not located "on a line". They are rather located in triangles as indicated in figure 3. This figure should explain how the filter is used to produce every necessary "position" in a SCIF signal.

The same filtering procedure given in figure 3 is used to convert either from (50 Hz/625lines) or (60 Hz/525lines).

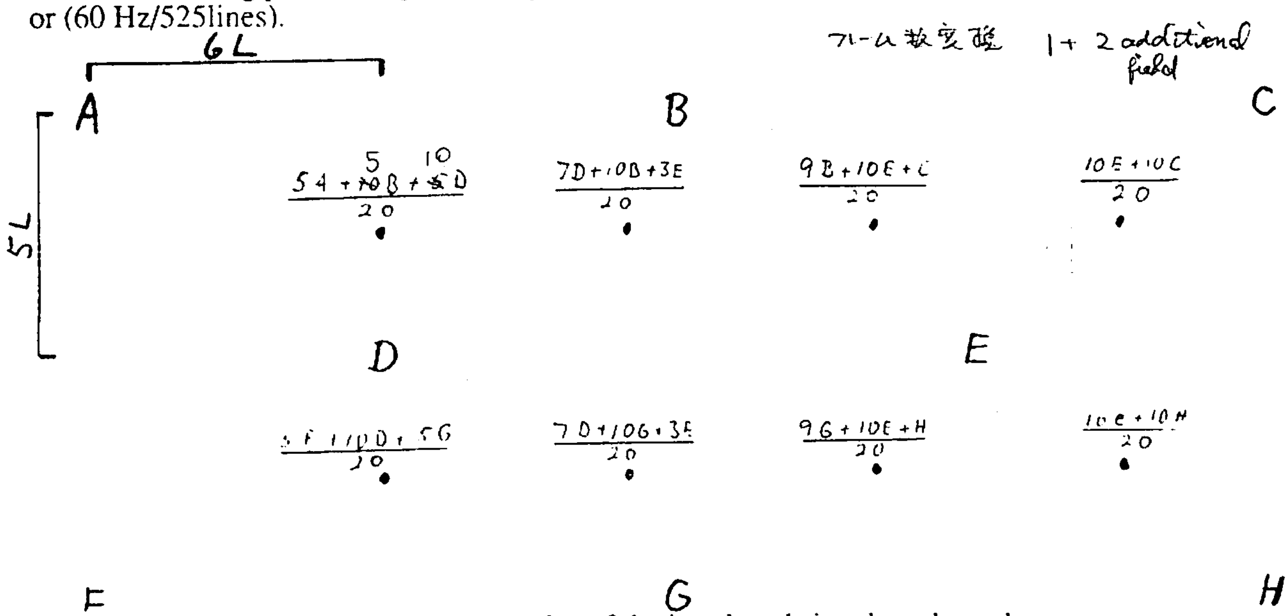


Figure 3. Capital letters show input samples of the interlaced signal. • show the generated SCIF samples together with the filter taps used.

Results.

The proposed filter has been used to convert parts of the sequences MOBCAL and FOOTBALL from (50 Hz/625lines) to SCIF. A synthetic picture of "moving lines" is also converted. The results are demonstrated on D1 tape.