CCITT
Question 4/XV
Specialists group on coding
for visual telephony
S/23/HP/22

Document n° 97

March 86

Title : Example of sequences at the common intermediate format and blur
Supporting document for video tapes from France and UK

Source : FRANCE

We present the COST sequence at the common intermediate format, at 30 Hz, we use at the input of the coder. This sequence has been achieved as follows :

- spatial filtering $\frac{1}{4}$ (1 2 1) and subsampling to perform the 720 to 360 conversion.

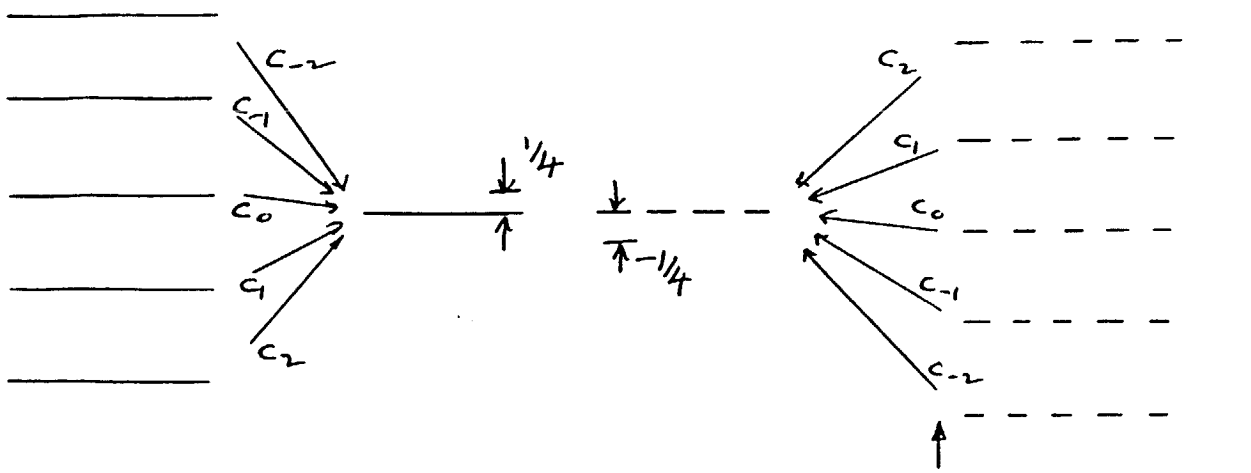
- Linear interpolation from 50 Hz to 30 Hz according BT-NTT document CCITT/85/55 "Standards Conversion to and from single Mode 288, 29.97 Format". Paragraphe 4 says :

The first step is to to form 228 line 50 Hz sequential. Alternate fields (20 ms each) have their lines shifted up and down by 1/4 of line pitch. (Line pitch here refers to spacing between two consecutive lines in one field). These shifts are performed by a 5-tap transversal arrangement, with two sets of coefficients which are used alternately on a field by field basis -figure 3(a). This process means that the spatial sample positions (ie lines) in all fields are the same. Averaging pairs of fields on running basis then gives 288, 50 sequentiel. Spatially, the process is equivalent to a 10-tap low pass filter cutting at 144 cycles per picture height and temporally a slow roll-off with a notch at 25 Hz introduced.

The second and final step is to reduce the frame rate to 29.97 Hz (actually 13.5 MHz/6/143/525 = 29.9700299...) by linear interpolation between the nearest two 50 Hz ones. If the desired output rate had been exactly 30 Hz then a simple 5:3 ratio would have applied, ie 3 phases to consider resulting in 3 pairs of coefficients. However, the ratio of PAL and NTSC field rates is precisely 1001:1200 so this conversion theoretically requires 600 pairs of coefficients. In pratice, this can be reduced by quantising the output positions to a smaller number of values and accepting some temporal sample position distortion. The demonstration tapes used 32 pairs of coefficients. This step is illustrated in figure 3(b).

PAL INPUT FIRST FIELD

PAL INPUT SECOND FIELD



NOTE INVERTED ORDER OF COEFFICIENTS

$C_{-2} = 26/256$

$C_{-1} = -46/256$

$C_0 = 232/256$

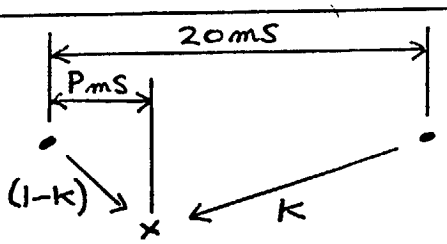
$C_1 = 77/256$

$C_2 = -33/256$

FIG 3(a)

288, 50 SEQUENTIAL INPUT FRAMES

288, 29.97 OUTPUT



$K = \frac{P}{20}$ ROUNDED TO NEAREST 1/32

FIG 3(b)

PAL → 288, 29.97

We then apply :

* an horizontal 3 - tap low pass filter $\frac{1}{4}$ (1 2 1)

* a vertical 10 - tap low pass filter

* a temporal low pass filter (averaging of pairs of fields)

* a noise reduction filter (temporal thresholding).

The result is : there is no more stripe in the COST sequence at the common intermediate format.

An other COST sequence has been achieved at the common intermediate format, by using the following filters :

* horizontal 35-tap low pass filter (Pirch filter)

* vertical 10-tap low pass filter

* temporal low pass filter (averaging of pairs of fields)

The results is : stripes are visible in the Trevor part of the COST sequence at the common intermediate format.

With a 5 tap LPF also stripes are present but less visible than with a 35 tap filter.

Conclusion

The absolute picture performance in terms of apparent spatial definition is dependant upon the implementation of the temporal and spatial filtering in the pre and post processors. This point should be borne in mind when comparing simulation results.