CCITT SGXV
Working Party XV/I
Experts Group for ATM Video Coding

Document AVC-240
March 1992

SOURCE : Japan
TITLE : PICTURE FORMAT CONVERSION ACCORDING TO AVC-203
PURPOSE : Information

1. Introduction

Pictures have been produced using format conversion filters suggested by NTA in Document AVC-203 (422 to SCIF conversion) and AVC-213 (SCIF to 422 conversion). These filters are for 5 to 12 up-conversion and 12 to 5 down- conversion, respectively, to obtain progressive scan SCIF(720x576 luminance pels, 59.94 non-interlaced pictures per second).

These filters are applied to both frame number conversion and line number conversion. Since test sequences and the simulation system are limited to the 525/60 system, frame rate conversion is simulated as 60 fields/sec to 72 frames/sec conversion or vice versa.

All the pictures have been observed on a 525/60 display. Pictures converted to and from CIF have also been produced for comparison.

A different set of format conversion filters has been also tried to check the possibility of improving the quality of converted pictures by allowing more hardware complexity and processing delay.

2. Tape demonstration

The following pictures are demonstrated by D1 (525/60 version);

		flow	mbcl	tble	foot	ssie	Note
A)	422 → SCIF frame rate conversion	X	X	X	X		2.4 times slow presentation
B)	422 → SCIF → 422 frame rate conversion	X	X	X	X	X	
C)	422 → SCIF → 422 line number conversion	X	X	X	X	X	
D)	422 → SCIF line number conversion	X	X	X	X	X	center 480 lines are presented, thus vertically 1.2 times elongated
E)	422 → CIF → 422 line number conversion	X	X	X	X	X	

It is noted that the down-conversion is in phase with the up-conversion in this experiment; starts of the original 10 fields (or lines) are synchronized between down-conversion and up-conversion.

3. Observations

1) Frame rate converted pictures noticeably lose spatial resolution and sharpness. They also become less bright. Furthermore, they show flicker having the same period as the conversion cycle of 10 original fields. The latter two phenomena are caused by the loss of spatial resolution and its fluctuation. If high frequency components are not displayed on a CRT display, the average brightness decreases due to the CRT's non-linear gamma characteristics. If the extent of resolution reduction fluctuates, then it causes large area flicker. Rapidly moving objects, such as football players and referees, become blurred.

2) Line number converted pictures also noticeably lose spatial resolution and become less bright. However, pictures are stable without showing fluctuation. Rapidly moving objects, such as football players and referees, become blurred.

3) Evaluation of how SCIF pictures look on the progressive scan monitor awaits the availability of such facilities. When they are observed on a 525/60 conventional monitor, frame rate converted SCIF pictures suffer the above mentioned flicker which is less visible because of less loss of resolution as well as 2.4 times slow presentation.

4. Improvement of filter characteristics

A different set of format conversion filters has been designed and evaluated. By allowing more hardware complexity and processing delay, there is a possibility of improving the quality of format converted pictures.

The filters consist of two parts, namely; (1) Interlace to Progressive Conversion Filter, and (2) Frame rate Conversion Filter. Although this particular combination of filters appears only for generating SCIF signals from 625/50 pictures, the experiment covers most major factors concerning the picture quality, since line number conversion required for generating from 525/60 pictures is relatively an easy task once a good quality progressive picture is obtained.

Interlace to Progressive Conversion Filter is a combination of a VT 2-dim Filter (3 x 7 taps) for $H \leq 1$ MHz signals, and a V 1-dim Filter (19 taps) for $H \geq 1$ MHz signals. Frame rate Conversion Filter is a T 1-dim Filter (33 taps). See ANNEX of this document for the detail.

A 525/60 signal is used as a source, and obtained SCIF like pictures (in this case, 525/1:1/72 due to the nature of the source) are observed by the same method as is described in Section 2.

It is observed that the spatial resolution is somewhat improved, but the motion smoothness, especially of an object moving rapidly, is still unsatisfactory.

5. Conclusion

As far as the reproduced pictures are observed, it is concluded that distortion due to the current format conversion is larger than the coding noise envisaged for directly coding 526/60 or 625/50 CCIR-601 pictures at 5- 10 Mbit/s. Particularly, frame rate conversion needs a remedy to remove the large area flicker.

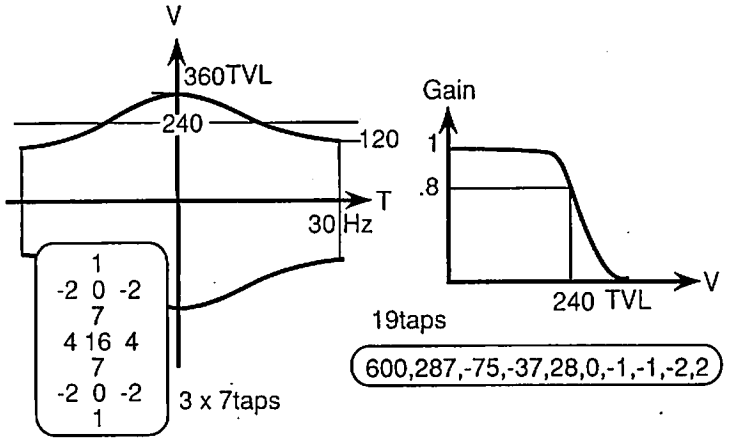
END

ANNEX

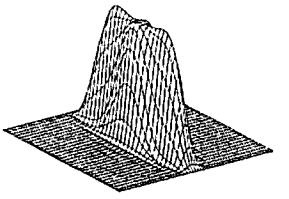
Characteristics of improved format conversion filters

Interlace to Progressive Conversion Filter

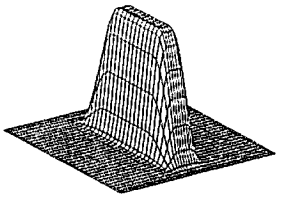
H freq: 0 - 1 MHz, VT 2-dim filter
1 - 6 MHz, V 1-dim filter



600,287,-75,-37,28,0,-1,-1,-2,2

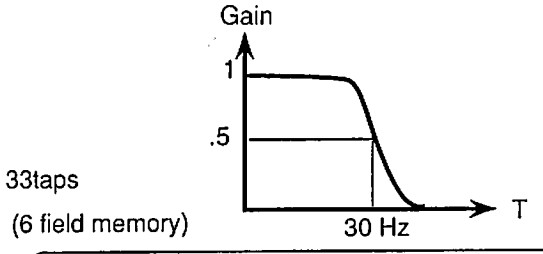


3-d plot of a VT filter

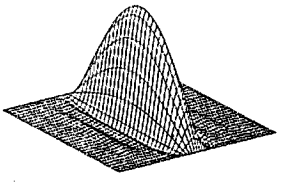


3-d plot of a V filter

Frame rate Conversion (5 : 6) Filter



166,158,134,100,62,27,0,-16,-22,-20,-13,-6,0,3,4,3,1



3-d plot of an NTA filter