2-15

Control Method for Digital Television Standards Converter

Koji Kinuhata, Hiroshi Sasaki, Hideo Yamamoto (KDD R&D Labs.), Goro Demizu, Koji Kuruma (Oki Electric)

1. Introduction

With the development of high-speed digital circuit technology and high-density digital memory elements, it has become possible to realize a conversion device that uses large-capacity digital memory and uses digital signal processing to replace the TV standard format conversion device that uses the conventional analog delay line switching method.

The advantages of encoding TV signals and converting the format are that signal storage processing is easy, signal deterioration is small, and the performance and reliability of equipment can be improved.

In this report, we consider the control method of the coded TV signal for conversion of the scanning method, and compare and examine two to three device configuration examples.

2. line conversion

There are two types of conversion between the 625/50 and 525/60 formats: conversion of the number of lines per field and conversion of the number of fields per second. For line conversion, a digital line memory is provided and controlled to periodically thin out or repeat lines. Another method is to control readout of a digital field memory provided for field conversion and process field conversion together.

3. field conversion

The conditions for field conversion are that 1) the temporal order of fields must not be reversed, 2) the temporal order of information within the same field must not be reversed, and 3) information of two consecutive fields must be obtained simultaneously in an appropriate interval for field interpolation. Under these conditions, a field memory having a storage capacity of about 1.5 fields is occasionally required for independent synchronous conversion. 1) Here, we will describe the case where the field memory (M) has a capacity of 2 fields and field conversion is performed.

As shown in FIGS. 1(a) and (b), the input signals are written in the order of input from address 0 of M, and after writing two fields, return to address 0 and repeat the writing. The information once written is memorized until it is rewritten after two fields. On the reading side, by comparing the difference PQ between the time reference points (625/50 system; P, 625/50 system; Q) within the field blanking period and V'-V=ΔV obtained from the field period V' of the 625/50 system and the field period V of the 525/60 system, the overlapping of reading and writing within the same field can be predicted.

PQ<=ΔV; cannot be read

PQ>ΔV; Readable

Stop reading fields predicted to overlap by. As shown in Figure 1,

PQ>ΔV

Since two fields can be read out simultaneously in a certain interval, appropriate field interpolation processing can be performed in this interval. When using 2-field memory, (625/50 → 525/60; D/C), simultaneous reading of 2 fields is possible in at least 4 field intervals per 6 to 7 field output intervals. In the case of the reverse (U/C), 2-field simultaneous reading is possible in at least 4 field intervals among 5 to 6 output field intervals. 1)

4. Configuration example of Digital System Converter (DTSC)

Figures 2, 3, and 4 show examples of DTSC configurations. All of them consist mainly of M, which has a storage capacity for two fields for field conversion. FIG. 2 shows a configuration close to the conventional delay line switching system 2). After demodulating the input TV signal into a luminance signal and a color difference signal, they are A-D converted. In the case of D/C (a), the line-converted signal is first written in M, and the written signal is read out at the field period of the output method to convert the number of fields, then field interpolation is performed, and after being converted back to an analog signal by a D-A converter, a signal of the desired standard method is obtained by the color encoder of the output method. In the case of U/C (b), line conversion is performed after field number conversion. In this method, the signal stored in M is 525 lines for both D/C and U/C, and the capacity of M can be saved.

Fig. 3 shows a method in which the input signal is stored in M for both D/C and U/C, and line number conversion and field number conversion are performed at once by readout control. In the case of D/C, since the 625/50 format signal is stored in M, the capacity of M increases by about 20% compared to Example 1, but processing using information for two fields is possible, so distortion of the converted image and degradation of resolution can be reduced.

Fig. 4 has only U/C functions, and is a method in which the composite NTSC signal is directly encoded and stored in M, the scanning method is converted by readout control, demodulated by digital processing, and modulated to PAL or SECAM. 3)

5. Conclusion

The control method for digital TV format conversion was briefly described, but in the future we would like to proceed with the study of a method that slightly increases the capacity of M in order to obtain high-quality converted images. In closing, I would like to express my gratitude to Deputy General Manager Kameda of KDD Research Laboratories, General Manager Amano of Terminal Equipment Laboratory, General Manager Yoshida of Oki Electric's Imaging Technology Department, and Manager Takahashi for their constant guidance.

References

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3) Telecom.Journal Vol.40-11/1973

word in diagram
Figure 1 Field conversion time chart
field memory
memory address
Writing
Reading
output signal

Figure 2 Configuration example 1
field interpolation
line interpolation transform

Figure 3 Configuration example 2
line interpolation
field interpolation

Figure 4 Configuration example 3
field interpolation
line interpolation transform

Nakameguro, Meguro Ward
International Telegraph and Telephone Research Institute
extension