

Description

The present invention concerns a scan reversing unit for video signals. Although not limited thereto, one application of scan reversal is in video telephone or conferencing systems where it is desired to display to the user his own (i.e. the transmitted) picture; it is subjectively more acceptable for this picture to be laterally inverted, because it is this image of himself in a mirror that the user is accustomed to seeing. Although this effect can be achieved on a CRT display simply by reversing the polarity of the line scanning coils, this involves switching of high peak voltages; moreover, reversal can not always be readily implemented on modern solid-state display devices.

The invention is concerned with apparatus for processing the video signal so that the resulting signal results in a laterally inverted display on a standard monitor. Previous such apparatus is described in US-A-4727411 and US-A-4220965. It is particularly concerned with video signals in which luminance and chrominance samples are interleaved, where the desired sample sequence is not simply the reverse of the input line.

The invention is defined in the claims below.

Some embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of one form of image reversing unit according to the invention;

Figure 2 is a timing diagram for the apparatus of Figure 1;

Figure 3 shows the contents of the memory 1 of the apparatus of Figure 1 at the end of the first line of an incoming frame;

Figure 4 shows the occupancy of the above locations at each clock period; and

Figure 5 illustrates schematically a user terminal for video communication incorporating the invention.

The scan reversal circuit shown in figure 1 is, for ease of illustration, designed to process a digital television signal having eight picture elements per line. Any practical system will of course have considerably more elements than this. Each pair of picture elements $n, n+1$ is represented by respective luminance values Y_n, Y_{n+1} and common chrominance (colour difference) values U_n and V_n - i.e. the horizontal chrominance resolution is half that of the luminance.

Each line of the input signal consists of a sequence of sixteen digital values, in sequence, viz: $Y_0 U_0 Y_1 V_0 Y_2 U_2 Y_3 V_2 Y_4 U_4 Y_5 V_4 Y_6 U_6 Y_7 V_6$, followed by a line blanking period.

The main part of the apparatus is a read-write memory 1 having sufficient locations to accommodate an entire line of the picture - i.e. in this example, sixteen locations $a_0 \dots a_{15}$. Its addresses are provided by an address generator 2, and system timing is

provided by two-phase clock generator 3 synchronous with the incoming digital values - i.e. the clock rate is twice the video pixel rate. During each clock period it produces clock pulses ϕ_R and ϕ_W during which, respectively, read and write operations to the memory take place.

The object of this arrangement is to write each line into the memory whilst reading out the preceding line in a sequence such that the resulting picture is laterally inverted when viewed. Note that the YUYV format under consideration means that the readout sequence is not the reverse of the write sequence. The resolution of this problem is best appreciated from the following description of the operation of the apparatus. Note that the address sequence produced by the address generator 2 repeats every two lines.

During the first line of a field, the address generator produces addresses a_0 to a_{15} in numerical order, as illustrated by the timing diagram in figure 2, and the incoming values Y_0, U_0, Y_1, V_0 etc are written in, in the sequence given above, under control of (active low) write clock pulses ϕ_W during the second half of each clock cycle.

The contents of the memory after the end of the first line are illustrated in figure 3.

In order that the scan-reversed line conforms to the format described above (YUYV) the readout sequence needs to be as follows:

$Y_7 U_6 Y_6 V_6 Y_5 U_4 Y_4 V_4$ etc

and therefore the required address sequence from the address generator 2 is:

$a_{14} a_{13} a_{12} a_{15} a_{10} a_9 a_8 a_{11}$ etc.

Readout commences at the beginning of the next line period, with readout of value Y_7 from location a_{14} , during the first part of the clock period. As soon as one location has been read out, it is possible to write in a digital value for the second line. However, although the obvious way to effect the writing of the second line is to write Y_0, U_0, Y_1, V_0 etc into locations in descending numerical order commencing with location a_{15} , this is not possible because that location is not yet free.

It would of course be possible to overcome this difficulty by commencing readout before the conclusion of the line blanking period, but this would necessitate additional buffering to delay the output. In this apparatus, therefore, successive values for the second line are written into the memory locations as they become free - i.e.

Y_0 into a_{14}

U_0 into a_{13}

Y_1 into a_{12}

V_0 into a_{15}

and so on.

This permits the use of a single address for both read and write; moreover, as will be seen below, it means that the sequence in which the data for the second line are written in is such that it can be read

out in the correct order by addressing the locations in the same order (a0, a1, a2, a3, a4 ... a15) as in the first line.

Figure 4 is a diagram showing the occupancy of the store locations at each clock period, over three line periods.

This invention is, as stated above, suitable for incorporation into videotelephone or videoconferencing apparatus. The details of such apparatus are not germane to the present invention, but are discussed in CCITT Standard H261 on Flexible Hardware for P*64 kbit/sec video, and in British Telecom Technology Journal Vol. 8 No. 3 July 1990 pages 28-35 "Video Codec hardware to realise a new World Standard" (M.D. Carr).

Referring to Figure 5, in a user terminal for such applications, the interleaved colour video signal derived from a camera 10 is formatted 11 for transmission into a YUPV format; image-reversed by a unit 12 according to the invention located in the terminal; and displayed on a local monitor VDU 13 within the terminal. Alternatively, it may be mixed, in conventional fashion, with the incoming video signal from another terminal, to provide an inset picture of the user in the image from the other terminal for display on a single VDU.

Claims

1. Apparatus for line inversion of an input television signal each line of which contains a time multiplex sequence of interleaved luminance samples and first and second chrominance samples, comprising a memory having an address generator arranged to produce during each two-line period first and second address sequences, each of one line period duration and read/write control means operable during a first line of the input signal to write the samples of that line of the input signal, in the order of receipt, into the locations specified by the generated sequence for that line and during subsequent lines of the input signal to read out samples from, and to write the samples of that line of the input signal, in the order of receipt, into, the locations specified by the generated sequence for that line, the two sequences being such that the output luminance samples are read out in the reverse order from that in which they were received, that the output first and second chrominance samples, considered separately, are read out in the reverse order from that in which they were received, and that the interleaving format of the read-out samples is the same as that of the input signal.
2. Terminal apparatus for video communication, including means for providing an input television

signal of the terminal user; apparatus according to claim 1 for line inversion thereof; and display means for displaying the reversed image thereby derived.

3. A method of line-inverting an input television signal each line of which contains a time multiplex sequence of interleaved luminance samples and first and second chrominance samples, comprising; writing a first line of samples into a memory in a first predetermined address sequence; reading it out in a second predetermined address sequence such that output luminance samples are read out in the reverse order from that in which they were received, that the output first and second chrominance samples, considered separately, are read out in the reverse order from that in which they were received, and that the interleaving format of the read-out samples is the same as that of the input signal; writing the next line of samples into the memory in the second sequence, and reading it out in the first sequence.

Patentansprüche

1. Vorrichtung für die Zeilenumkehr eines Fernseh-eingangssignals, das in jeder Zeile eine Zeitmultiplexsequenz von miteinander verschachtelten Luminanzabtastwerten und ersten und zweiten Chrominanzabtastwerten enthält, mit einem Speicher, der einen Adressengenerator aufweist, der dazu dient, während einer jeden Zweizeilenperiode erste und zweite Adressensequenzen jeweils von der Dauer einer Einzeilenperiode zu erzeugen, sowie mit einer Lese-/Schreib-Steuereinrichtung, die während einer ersten Zeile des Eingangssignals betriebsbereit ist, um die Abtastwerte dieser Zeile des Eingangssignals in der Reihenfolge des Empfangs an die Stellen zu schreiben, die mittels der erzeugten Sequenz für diese Zeile bezeichnet sind, um während der folgenden Zeilen des Eingangssignals Abtastwerte auszulesen aus den und um die Abtastwerte dieser Zeile des Eingangssignals in der Reihenfolge des Empfangs zu schreiben in die Stellen, die mittels der erzeugten Sequenz für diese Zeile bezeichnet sind, wobei die beiden Sequenzen so beschaffen sind, daß die ausgegebenen Luminanzabtastwerte in der gegenüber dem Empfang umgekehrten Reihenfolge ausgelesen werden, daß die ausgegebenen ersten und zweiten Chrominanzabtastwerte, getrennt betrachtet, in der gegenüber dem Empfang umgekehrten Reihenfolge ausgelesen werden und daß das Verschachtelungsformat der ausgelesenen Abtastwerte gleich dem des Eingangssignals ist.



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1. Apparatus for line inversion of an input television signal each line of which contains a time multiplex sequence of interleaved luminance samples and first and second chrominance samples,

comprising a memory having an address generator arranged to produce during each two-line period first and second address sequences, each of one line period duration and read/write control means operable during a first line of the input signal to write the samples of that line of the input signal, in the order of receipt, into the locations specified by the generated sequence for that line and during subsequent lines of the input signal to read out samples from, and to write the samples of that line of the input signal, in the order of receipt, into, the locations specified by the generated sequence for that line, the two sequences being such that the output luminance samples are read out in the reverse order from that in which they were received, that the output first and second chrominance samples, considered separately, are read out in the reverse order from that in which they were received, and that the interleaving format of the read-out samples is the same as that of the input signal.

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Patentansprüche

1. Vorrichtung für die Zeilenumkehr eines Fernseheingangssignals, das in jeder Zeile eine Zeitmultiplexsequenz von miteinander verschachtelten Luminanzabtastwerten und ersten und zweiten Chrominanzabtastwerten enthält, mit einem Speicher, der einen Adressengenerator aufweist, der dazu dient, während einer jeden Zweizeilenperiode erste und zweite Adressensequenzen jeweils von der Dauer einer Einzeilenperiode zu erzeugen, sowie mit einer Lese-/Schreib-Steuereinrichtung, die während einer ersten Zeile des Eingangssignals betriebsbereit ist, um die Abtastwerte dieser Zeile des Eingangssignals in der Reihenfolge des Empfangs an die Stellen zu schreiben, die mittels der erzeugten Sequenz für diese Zeile bezeichnet sind, um während der folgenden Zeilen des Eingangssignals Abtastwerte auszulesen aus den und um die Abtastwerte dieser Zeile des Eingangssignals in der Reihenfolge des Empfangs zu schreiben in die Stellen, die mittels der erzeugten Sequenz für diese Zeile bezeichnet sind, wobei die beiden Sequenzen so beschaffen sind, daß die ausgegebenen Luminanzabtastwerte in der gegenüber dem Empfang umgekehrten Reihenfolge ausgelesen werden, daß die ausgegebenen ersten und zweiten Chrominanzabtastwerte, getrennt betrachtet, in der gegenüber dem Empfang umgekehrten Reihenfolge ausgelesen werden und daß das Verschachtelungsformat der ausgelesenen Abtastwerte gleich dem des Eingangssignals ist.



2. Datenendgerät für Video-Datenübermittlung, das eine Vorrichtung, die ein Fernseheingangssignal des Endgerät-Benutzers bereitstellt, eine Vorrichtung nach Anspruch 1 für die Zeilenumkehr desselben und eine Anzeigevorrichtung enthält, die das dadurch abgeleitete umgekehrte Bild darstellt.
3. Verfahren zur Zeilenumkehr eines Fernseheingangssignals, das in jeder Zeile eine Zeitmultiplexsequenz von miteinander verschachtelten Luminanzabtastwerten und ersten und zweiten Chrominanzabtastwerten enthält, bei dem eine erste Zeile von Abtastwerten in einer ersten vorbestimmten Adressensequenz in einen Speicher geschrieben wird, sie in einer zweiten vorbestimmten Adressensequenz so ausgelesen wird, daß die ausgegebenen Luminanzabtastwerte in der gegenüber dem Empfang umgekehrten Reihenfolge ausgelesen werden, daß die ausgegebenen ersten und zweiten Chrominanzabtastwerte, getrennt betrachtet, gegenüber dem Empfang umgekehrten Reihenfolge ausgelesen werden und daß das Verschachtelungsformat der ausgelesenen Abtastwerte gleich dem des Eingabesignals ist, die nächste Zeile von Abtastwerten in der zweiten Sequenz in den Speicher geschrieben wird und sie in der ersten Sequenz ausgelesen wird.

Revendications

1. Appareil pour inversion de la ligne d'un signal télévision en entrée, dont chaque ligne contient une séquence multiplexée dans le temps d'échantillons de luminance et de premier et second échantillons de chrominance entrelacés, comprenant une mémoire comportant un générateur d'adresse prévu pour produire pendant chaque période de deux lignes des première et seconde séquences d'adresse et un moyen de commande de lecture/écriture et de durée de chaque période d'une ligne mis en oeuvre pendant une première ligne de signal d'entrée afin d'écrire les échantillons de cette ligne du signal d'entrée, dans l'ordre de réception, dans les emplacements spécifiés par la séquence produite pour cette ligne et pendant les lignes suivantes du signal d'entrée, pour extraire les échantillons et écrire les échantillons de cette ligne du signal d'entrée, dans l'ordre de réception, dans les emplacements spécifiés par la séquence produite pour cette ligne, les deux séquences étant telles que les échantillons de luminance de sortie soient extraits dans l'ordre inverse de celui dans lequel il ont été reçus, que les premier et second échantillons de chrominance de sortie, considérés séparément, soient extraits dans l'ordre in-

verse de celui dans lequel ils ont été reçus et que le format d'entrelacement des échantillons extraits soit le même que celui du signal d'entrée.

2. Terminal pour communication vidéo comportant un moyen pour délivrer un signal de télévision d'entrée de l'utilisateur du terminal, un appareil selon la revendication 1, pour l'inversion de ligne de celui-ci et un moyen de visualisation pour visualiser l'image inversée obtenue par celui-ci.
3. Procédé d'inversion de ligne d'un signal de télévision d'entrée, dont chaque ligne contient une séquence multiplexée dans le temps d'échantillons de luminance et de premier et second échantillons de chrominance entrelacés, comprenant les étapes consistant à :
écrire une première ligne d'échantillons dans une mémoire selon une première séquence d'adresse prédéterminée, les extraire selon une seconde séquence d'adresse prédéterminée, de sorte que les échantillons de luminance en sortie soient extraits dans l'ordre inverse de celui dans lequel ils ont été reçus, que les premier et second échantillons de chrominance en sortie, considérés séparément, soient extraits dans l'ordre inverse de celui dans lequel ils ont été reçus et que le format d'entrelacement des échantillons extraits soit le même que celui du signal d'entrée, écrire la ligne suivante des échantillons dans la mémoire dans la seconde séquence et les extraire selon la première séquence.