

**A METHOD AND CIRCUIT FOR CORRECTION
OF HORIZONTAL EDGES**

5 The present invention relates to a method and circuit for correction of horizontal edges in a digital image signal processing system.

10 The correction of horizontal edges in a High Definition digital Television (HDTV) or in a Video Tape Recorder (VTR) is to emphasize the horizontal edges. Heretofore, for the correction of horizontal edges, signals of corresponding frequency bands are respectively extracted from a luminance signal source, by using a band pass filter of 2.4MHz and a band pass filter of 3.58MHz, the signal of each band is multiplied by a coefficient for emphasis or attenuation, these two signals are composed, and then the composed signal is again composed with the luminance signal source, as illustrated in the prior art example of Figure 1 of the
15 accompanying diagrammatic drawings.

20 However, such a prior art arrangement as described above has the disadvantage that the high frequency component signal of luminance is not corrected, and a circuit for high frequency component correction is indispensable when it is considered that the signal for a HDTV in the future can load image information even on the high frequency component of luminance.

25 Preferred embodiments of the present invention aim to provide methods and circuits which correct horizontal edges by emphasizing a high frequency component of luminance and attenuating the band of colour signal.

30 According to a first aspect of the present invention, there is provided a circuit for correcting horizontal edges in a digital image signal processing system, the circuit comprising:

a first filtering means for filtering low frequency components of an input luminance signal;

5 a second filtering means for filtering medium frequency components of said input luminance signal;

a third filtering means for filtering high frequency components of said input luminance signal;

10 a first gain controller means, coupled to said first filtering means, for controlling gain of the luminance signal from said first filtering means on the basis of a first control signal;

15 a second gain controller means, coupled to said second filtering means, for controlling gain of the luminance signal from said second filtering means on the basis of a second control signal;

20 a third gain controller means, coupled to the third filtering means, for controlling gain of the luminance signal from the third filtering means on the basis of a third control signal; and

25 mixer means for mixing said input luminance signal with the luminance signals from said first to third filtering means in order to obtain a final output signal with horizontal edge correction.

Preferably, said mixer means comprises:

30 a first mixer means for mixing said input luminance signal with an output of said first gain controller means to obtain a first output signal;

a second mixer means for mixing an output of said second gain controller means with an output of said third gain controller means to obtain a second output signal; and

5 a third mixer means for mixing said first output signal with said second output signal to obtain said final output signal.

In a second aspect, the invention provides a method of correcting horizontal edges in a digital image signal processing system, the method comprising the steps
10 of:

filtering an input luminance signal to obtain therefrom a low frequency component signal, a medium frequency component signal and a high frequency component signal;

15 controlling the gain of each of said low frequency component signal, said medium frequency component signal and said high frequency component signal on the basis of a respective control signal; and

20 mixing said input luminance signal with the gain-controlled low, medium and high frequency component signals to thereby produce an output luminance signal corrected in horizontal edges.

Preferably, said mixing step comprises the steps of:

25 mixing said input luminance signal with said gain controlled luminance signal of said low frequency component signal to obtain a first output signal;

mixing said gain controlled luminance signal of said medium frequency component signal with said gain controlled luminance signal of said high frequency component signal to obtain a second output signal; and

- 5 mixing said first output signal with said second output signal to thereby produce a final output luminance signal corrected in horizontal edges.

The invention extends to a digital image processing system provided with a circuit as above, in accordance with the first aspect of the invention. The
10 invention also extends to a High Definition Television or Video Recorder having such a digital image processing system.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to
15 Figure 2 of the accompanying diagrammatic drawings, which is a block diagram of one example of a horizontal edge correction circuit diagram embodying the present invention.

Referring to Figure 2, a first band pass filter (BPF1) is arranged to
20 filter a low frequency component signal from an input luminance signal (Y). A second band pass filter (BPF2) is arranged to filter a medium frequency component signal from the input luminance signal (Y). A third band pass filter (BPF3) is arranged to filter a high frequency component signal from the input luminance signal (Y).

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A first gain controller (GC1) is arranged to control the gain of the output from the first band pass filter according to a first prescribed gain signal (HG1). A second gain controller (GC2) is arranged to control the gain of the output from the second band pass filter according to a second prescribed gain signal (HG2). A third

gain controller (GC3) is arranged to control the gain of the output from the third band pass filter according to a third prescribed gain signal (HG3).

A first signal mixer (MIX1) is arranged to mix the input luminance signal (Y) with the first luminance signal (Y1) from the first gain controller (GC1) so as to obtain a first output signal. A second signal mixer (MIX2) is arranged to mix the second luminance signal (Y2) from the second gain controller (GC2) with the third luminance signal (Y3) from the third gain controller (GC3) so as to obtain a second output signal. A third signal mixer (MIX3) is arranged to mix the first output signal with the second output signal so as to obtain a final output signal (Yout2).

In an image processing system such as that of an HDTV, a portion of the horizontal edges may be corrected by emphasizing a high frequency luminance component and attenuating a colour signal band. The correcting circuit may be formed as illustrated in Figure 2 and operate as follows.

A luminance signal which has 2.58MHz as its peak value is extracted through the first band pass filter (BPF1) from the original luminance signal, and the first luminance signal (Y1) is obtained by multiplying the extracted luminance signal by the first prescribed value of gain (HG1) in the first gain controller (GC1).

The first luminance signal (Y1) is added to the original luminance signal (Y) by the first signal mixer (MIX1) and the first mixed luminance signal (Y4) is thereby produced.

At the same time, a luminance signal which has 3.58MHz as its peak value is extracted through the second band pass filter (BPF2) and the second luminance signal (Y2) is extracted by multiplying the extracted signal by the second prescribed value of gain (HG2) in the second gain controller (GC2).

Likewise, a luminance signal which has 4.58MHz as its peak value is extracted in the third band pass filter (BPF3) and then the third luminance signal (Y3) is produced by multiplying the extracted signal by the third prescribed value of gain (HG3) in the third gain controller (GC3). Here, each value of gain may be
5 determined as an increasing or decreasing coefficient by the control of its user or can be controlled from a reference value table in a controlling microcomputer.

The second mixed luminance signal (Y5) is obtained by the mixing of the second and third luminance signals (Y2, Y3) in the second signal mixer (MIX2) and
10 the luminance signal (Yout2) whose horizontal edges are corrected is obtained by the addition of the first mixed luminance signal (Y4) to the second mixed luminance signal (Y5).

The luminance signal (Yout2) whose horizontal edges are corrected by
15 mixing as mentioned above can be expressed as a formula (1) given below.

$$Y_{out2} = (Y + Y1) + (Y2 + Y3) = Y4 + Y5 \dots(1)$$

Thus, the illustrated embodiment may have the advantage of improving
20 resolving power by enabling horizontal edges to be freely controlled and enabling not only medium and low but also high frequency component luminance signals to be corrected by controlling the gain of band pass filters in each band.

While the invention has been particularly shown and described with reference
25 to a preferred embodiment, it will be understood by those skilled in the art that modifications in detail may be made without departing from the scope of the invention.



CLAIMS:

1. A circuit for correcting horizontal edges in a digital image signal processing system, the circuit comprising:

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a first filtering means for filtering low frequency components of an input luminance signal;

10 a second filtering means for filtering medium frequency components of said input luminance signal;

a third filtering means for filtering high frequency components of said input luminance signal;

15 a first gain controller means, coupled to said first filtering means, for controlling gain of the luminance signal from said first filtering means on the basis of a first control signal;

20 a second gain controller means, coupled to said second filtering means, for controlling gain of the luminance signal from said second filtering means on the basis of a second control signal;

25 a third gain controller means, coupled to the third filtering means, for controlling gain of the luminance signal from the third filtering means on the basis of a third control signal; and

mixer means for mixing said input luminance signal with the luminance signals from said first to third filtering means in order to obtain a final output signal with horizontal edge correction.

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2. A circuit according to Claim 1, wherein said mixer means comprises:

a first mixer means for mixing said input luminance signal with an output of said first gain controller means to obtain a first output signal;

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a second mixer means for mixing an output of said second gain controller means with an output of said third gain controller means to obtain a second output signal; and

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a third mixer means for mixing said first output signal with said second output signal to obtain said final output signal.

3. A method of correcting horizontal edges in a digital image signal processing system, the method comprising the steps of:

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filtering an input luminance signal to obtain therefrom a low frequency component signal, a medium frequency component signal and a high frequency component signal;

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controlling the gain of each of said low frequency component signal, said medium frequency component signal and said high frequency component signal on the basis of a respective control signal; and

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mixing said input luminance signal with the gain-controlled low, medium and high frequency component signals to thereby produce an output luminance signal corrected in horizontal edges.



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4. A method according to claim 3, wherein said mixing step comprises the steps of:

5 mixing said input luminance signal with said gain controlled luminance signal of said low frequency component signal to obtain a first output signal;

mixing said gain controlled luminance signal of said medium frequency component signal with said gain controlled luminance signal of said high frequency component signal to obtain a second output signal; and

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mixing said first output signal with said second output signal to thereby produce a final output luminance signal corrected in horizontal edges.

15 5. A circuit for correcting horizontal edges in a digital image signal processing system, the circuit being substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

20 6. A method of correcting horizontal edges in a digital image signal processing system, the method being substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

7. A digital image processing system provided with a circuit according to Claim 1, 2 or 5.

25 8. A High Definition Television or Video Recorder having a digital image processing system according to Claim 7.
