Description

The present invention relates to signal offset circuitry for use in a digital deghosting system.

Ghost images can be produced on the screen of a television receiver when both the desired RF signal for a selected channel and time delayed versions of the same RF signal are received by the tuner. The desired and delayed RF signals are demodulated to form desired and delayed video signals from which a main and ghost image is produced. In the case of broadcast channels, delayed RF signals may be produced when the transmitted RF signal is reflected from objects, such as buildings or mountains. In the case of cable channels, delayed RF signals may be produced when the desired RF signal is reflected from improper cable terminations in the cable distribution system. When there are multiple delayed RF signals, as when a transmitted RF signals is reflected by more than one object, multiple ghost images may be produced.

In a typical digital deghosting system, ghost contaminated video signals are digitized by an analog-to-digital converter (ADC) and delayed by successive stages of a digital delay line. The output signals from respective stages are adjusted in amplitude (or weighted) so that when all of the delayed and weighted signals are combined they form a psuedo ghost signal. The psuedo ghost signal is combined with the ghost contaminated video signals to cancel their ghost signal components.

The amount of delay provided by each stage of the delay line and the factor by which the output signal of each stage is weighted are determined by examining the digitized input signals during a training interval. The input signal provided during the training interval (the training signal) desirably exhibits a substantially constant value for a period of time sufficient to encompass the ghosts of the signals which precede the training signal, a transition or other singularity, and a substantially constant value for a period of time sufficient to include all of the ghosts induced by the transition or singularity.

For signals developed under the NTSC standard the interval between the trailing edge of the sixth pre-equalization pulse and the leading edge of the first serration can serve as an acceptable training signal. This interval includes approximately one-half of the horizontal line period ($\frac{1}{2}$H) when the amplitude of the video signal is substantially constant at the black level value (0 IRE), a transition (the leading edge of the vertical synchronization pulse) and an interval of approximately $\frac{1}{2}$H when the amplitude of the video signal is substantially constant at the sync-tip value (-40 IRE). The waveform of this training signal is shown in FIGURE 1A.

The ADC's typically used in digital video signal processors digitize the input signals to occupy the full dynamic range of the ADC. Under the NTSC standard, a video signal may occupy a range of values between -40 IRE (sync-tip) and 100 IRE (white level). For a video signal which is digitized by an eight-bit ADC, having a dynamic range from -127 to +127, for example, a white level signal may be converted to a digital value of 120 and a sync-tip signal to a digital value of -120.

The use of substantially all of the dynamic range of the ADC to digitize standard signals may present problems in a digital deghosting system which uses the training signal set forth above. In the exemplary deghosting system described above, the portion of the training signal following the leading edge of the vertical sync pulse and having an amplitude of -40 IRE (sync-tip) is monitored for ghosts of the vertical sync transition to determine the timing, amplitude and polarity of the ghost signals. Since this signal is digitized to have values near the bottom of the dynamic range of the ADC, ghost signal components may cause the analog input signal to have values which are not correctly digitized by the ADC.

FIGURE 1B shows an exemplary training signal which includes a positive ghost signal component that is reduced in amplitude by 6 dB relative to the desired signal. At the left margin of FIGURE 1B is a scale indicating the digital values corresponding to the analog levels. From this scale it is noted that the -60 IRE amplitude value of the combination of the vertical sync pulse and its 6 dB ghost signal component is outside of the range of values which can be converted by the ADC. Assuming that the ADC converts all of the values below its range to have digital values of -127, the amplitude of ghost signal shown in FIGURE 1B may be seriously underestimated. Also, any additional positive ghost signals superimposed on this ghost signal may be lost entirely. One solution to this problem is to increase the range of analog values which may be represented within the dynamic range of the ADC. This solution is undesirable, however, because it decreases the number of digital values which may be used to represent the image information in the video signal, increasing the quantization distortion of the image.

In GB-A-130839 there is disclosed a system employing offsetting and analog to digital converter gain changing to effect a higher digital resolution of selected components of an analog video input signal than could otherwise be obtained. Briefly, in the disclosed system different portions of a video line are treated differently for maximizing the digital resolution of the line portions. Specifically, the off-

set and gain of a digital to analog converter are changed during a line interval to maximize the digital resolution of the horizontal synchronizing signal, the burst signal interval and the active video signal interval. By this means one obtains a maximum number of digital signal levels for the three intervals as compared with the conventional approach of digitizing all three intervals within a fixed range of digital values. However, GB-A-2130839 is not concerned with locating and subsequently cancelling ghost information which may occur during an initial training interval prior to the active video signal.

The present invention provides in one aspect a method of deghosting a video signal by means of signal offset circuitry, the circuitry comprising: a source for providing an analog video signal having a training signal component; an analog-to-digital converter coupled to said source for developing a digital signal representative of said analog video signal; first means coupled to said source for developing a control signal corresponding to a predetermined interval; and second means coupled to said analog-to-digital converter and responsive to said control signal for changing the correspondence between said analog video signals and said digital signal during said predetermined interval, characterized in that the method comprises selecting a portion of the vertical synchronizing interval of said analog video signal to represent the training signal component, said portion having a dynamic range normally extending from black level to synch tip level and which may include a ghost component which, when present, may tend to exceed the input signal dynamic range of said analog to digital converter thus resulting in ghost amplitude clipping and a corresponding loss of ghost signal amplitude information; producing, by said first means, said control signal only during said selected portion of said vertical synchronizing interval of said analog video signal; altering said correspondence, with said second means, between said training signal level and said input signal range of said converter such that said analog to digital converter does not clip peaks of the ghost component of the training signal for preventing said loss of said ghost amplitude information; and employing digital de-ghosting circuitry connected to an output of said analog to digital converter and responsive to said training signal having preserved ghost amplitude information for removing said ghost component from the active video portions of the digitised video signal provided by said analog to digital converter.

In another aspect, the invention provides signal offset circuitry comprising: a source for providing an analog video signal having a training signal component; an analog-to-digital converter coupled to said source for developing a digital signal representative of said analog video signal; first means coupled to said source for developing a control signal corresponding to a predetermined interval; and second means coupled to said analog-to-digital converter and responsive to said control signal for changing the correspondence between said analog video signals and said digital signal during said predetermined interval, characterized in that said first means is operative to select as said training signal component in which the control signal is developed, a portion of vertical synchronizing interval of said analog video signal having a dynamic range normally extending from black level to synch tip level said second means being responsive to said control signal to alter said correspondence between said training signal level and said input signal range of said converter such that said analog to digital converter does not clip peaks of the ghost component of the training signal for preventing loss of said ghost amplitude information; and including digital de-ghosting circuitry connected to an output of said analog to digital converter and responsive to said training signal having preserved ghost amplitude information for removing said ghost component from the active video portions of the digitized video signal provided by said analog to digital converter.

An embodiment of the present invention comprises offset circuitry including a source of analog video signals having desired and delayed desired (ghost) signal components, each including synchronizing signal components. Means are coupled to the source for developing a control signal corresponding to a predetermined interval of the analog video signals. The predetermined interval includes a portion of the synchronizing signal components of the desired signals. An analog-to-digital converter is coupled to the source for developing digital samples representing the analog-to-digital converter and are responsive to the control signal for changing the correspondence between the analog video signals and the digital samples during the predetermined interval. Digital deghosting circuitry is included and is responsive to the digital samples provided by the analog-to-digital converter during the predetermined interval. This determines the amplitude and timing of the ghost signals relative to the desired signals.

FIGURES 1A, 1B AND 1C are graphs of amplitude versus time showing waveforms that are useful for explaining the operation of the embodiment of the invention shown in FIGURE 2.

FIGURE 2 is a block diagram, partially in schematic diagram form showing a portion of a television receiver embodying the present invention.

In the drawings, broad arrows represent busses for multiple-bit parallel digital signals and line arrows represent connections carrying analog signals

or single bit digital signals. Depending on the processing speed of the devices, compensating delays may be required in certain of the signal paths. One skilled in the art of digital signal processing circuit design would know where such delays would be needed in a particular system.

In FIGURE 2, tuner and IF circuitry 12, which may, for example, include the tuner and intermediate frequency (IF) filtering and amplification circuitry of a conventional television receiver, receives modulated video signals via antenna 10 and provides IF signals representative of the signals from a predetermined channel to a video detector 14. The video detector, which may, for example, include a conventional synchronous detector, provides baseband composite video signals, CV, at its output port. The output port of video detector 14 is connected to a detector 16 and via a resistor 24 to an ADC 26.

The detector 16 is responsive to the line and field synchronization signal components of the signals CV. It detects the last (sixth) pre-equalization pulse preceding the vertical synchronization pulse interval. The detector 16 may, for example, include a counter (not shown) which is enabled during the vertical blanking interval to count pulses in the composite synchronizing signal. The pulses counted during this interval are the pre-equalization pulses. The output signal provided by the detector 16 to the timing circuitry 18 is a pulse which is substantially coincident with the sixth pre-equalization pulse.

Timing circuitry 18, which may, for example, include a monostable multivibrator, produces a pulse signal, T, which is in a first state during the training interval (e.g. for one horizontal line period following the trailing edge of the sixth pre-equalization pulse) and is in a second state otherwise. The pulse signal T is illustrated in FIGURE 1C.

During the training signal interval, the signal T closes a switch 22 conditioning it to apply the current from a current source 20 to the interconnection of the resistor 24 and the ADC 26. The current from source 20 flows through the resistor 24 to develop a positive potential offset at the input terminal of the ADC 26 during the training signal interval. This potential offset changes the amplitude of the video signals applied to the ADC during the training interval so that the ghost images of the leading edge of the vertical sync pulse are converted to distinguishable values within the dynamic range of the ADC 26.

The value of the potential offset is determined by the selection of the resistor 24 and the current source 20. The actual potential offset used in a system depends on the range of potentials which the input signal may occupy. To simplify explanation of the invention, the potential will be described in standard IRE units. One skilled in the art of television circuit design would be able to convert these IRE values into actual potentials for a given system.

ADC 26 converts the video signals applied to its input port into digital values. The digital video signals are applied to digital deghosting circuitry 28 which may, for example, be similar to that shown in U.S. Patent No. 4,542,408 entitled "Digital Deghosting System". The deghosted video signals provided by the circuitry 28 may be applied to conventional digital video signal processing circuitry (not shown) to develop a ghost free image on a display device (not shown).

The digital deghosting circuitry 28 may, for example, determine the timing and amplitude of ghost signals by differentiating the training signal. Ideally, the largest pulse in this differentiated signal corresponds to the leading edge of the vertical sync pulse and any subsequent pulses correspond to ghost images of the vertical sync pulse. The timing of the ghost signals relative to the desired signal can be determined from the delay between the largest pulse in the differentiated signal and each of the smaller subsequent pulses. Similarly, the relative amplitude of each of the ghost signals to the desired signal can be determined as the relative amplitude of each of the smaller pulses to the largest pulse.

If the offset added to the training signal at the input to the ADC has a sufficient magnitude, the steps in the digitized training signal and, consequently, the pulses in the differentiated signal will have the amplitude values which correspond to the respective ghost signals. While an offset of from 20 IRE to 40 IRE may result in adequate deghosting of many ghost-contaminated signals, a larger offset may be desirable to compensate for possible nonlinearities in the ADC and to improve the performance of the deghosting circuitry for noisy signals.

A nonlinear ADC, as used in this application, is one which has varying quantization resolution over its dynamic range. Stated another way, a nonlinear ADC translates a given analog difference value into various digital difference values depending on where in the dynamic range of the ADC the analog difference value lies. An ADC which is nonlinear near the bottom end of its dynamic range may be acceptable for use in a digital television receiver that does not include deghosting circuitry because the portions of the video signal having values in this region (i.e. the synchronization pulses) contain relatively small amounts of information.

In the digital deghosting system set forth above, however, the portion of the training having a nominal value of sync-tip has all of the ghost signal information. If, for example, the quantization resolution in the range of values occupied by sync pulses

is more coarse than in the range of values occupied by active video signals, the deghosting system may overcompensate for the ghost signal components in the video signals it processes and introduce ghost signals of opposite polarity. This type of error can be corrected by using the present invention to shift the training signal into the range of values occupied by the active video signals before it is digitized. In the system described above, a shift of from 60 to 80 IRE would be sufficient for this purpose.

Depending on the structure of the ghost detecting circuitry used in the deghosting system, it may be difficult to distinguish between impulse noise in the training interval and ghost signals. Ghost detecting circuitry which differentiates the training signal, for example, produces pulses corresponding to ghost images of the leading edge of vertical sync. This differentiation operation will also produce pulses corresponding to noise impulses in the training interval. Some of these noise pulses may be eliminated by conditioning the ghost detecting circuitry to ignore pulses having amplitudes greater than the sync-tip value (40 IRE). Since ghost signals occurring in the training interval are images of the leading edge of vertical sync, they should not have differential amplitudes greater than 40 IRE.

To distinguish between large amplitude impulse noise and ghost signals, the offset used for the ADC is desirably large enough to prevent the noise pulses from being clipped at or below the sync tip value. Since both positive and negative noise impulses may contaminate the video signals, it may be desirable to select an offset value to position the sync tip value in the center of the dynamic range of the ADC. In the present embodiment, for example, this offset value is 70 IRE.

Although the present embodiment of the invention develops an offset potential by adding current to the analog input signals, other means may be used to change the correspondence between the analog signals and the digital values developed by the ADC. For example, the potential reference used by the ADC to develop reference input signals for its comparators may be selectively shifted during the training interval to change the correspondence between the analog input values and digital output values by an amount equivalent to a desired offset potential.

Claims

1. A method of de-ghosting a video signal by means of signal offset circuitry, the circuitry comprising:

a source (10-14) for providing an analog video signal having a training signal component;

an analog-to-digital converter (26) coupled to said source for developing a digital signal representative of said analog video signal;

first means (16,18) coupled to said source for developing a control signal (T) corresponding to a predetermined interval; and

second means (20-24) coupled to said analog-to-digital converter and responsive to said control signal for changing the correspondence between said analog video signals and said digital signal during said predetermined interval,

characterized in that the method comprises selecting a portion of the vertical synchronizing interval of said analog video signal to represent the training signal component, said portion having a dynamic range normally extending from black level to synch tip level and which may include a ghost component which, when present, may tend to exceed the input signal dynamic range of said analog to digital converter (26) thus resulting in ghost amplitude clipping and a corresponding loss of ghost signal amplitude information;

producing, by said first means, said control signal only during said selected portion of said vertical synchronizing interval of said analog video signal;

altering said correspondence, with said second means (20,22,24), between said training signal level and said input signal range of said converter such that said analog to digital converter does not clip peaks of the ghost component of the training signal for preventing said loss of said ghost amplitude information; and

employing digital de-ghosting circuitry (28) connected to an output of said analog to digital converter (26) and responsive to said training signal having preserved ghost amplitude information for removing said ghost component from the active video portions of the digitized video signal provided by said analog to digital converter.

2. Signal offset circuitry for carrying out the method of claim 1, comprising:

a source (10-14) for providing an analog video signal having a training signal component;

an analog-to-digital converter (26) coupled to said source for developing a digital signal representative of said analog video signal;

first means (16,18) coupled to said source for developing a control signal (T) corresponding to a predetermined interval; and

second means (20-24) coupled to said analog-to-digital converter and responsive to

is more coarse than in the range of values occupied by active video signals, the deghosting system may overcompensate for the ghost signal components in the video signals it processes and introduce ghost signals of opposite polarity. This type of error can be corrected by using the present invention to shift the training signal into the range of values occupied by the active video signals before it is digitized. In the system described above, a shift of from 60 to 80 IRE would be sufficient for this purpose.

Depending on the structure of the ghost detecting circuitry used in the deghosting system, it may be difficult to distinguish between impulse noise in the training interval and ghost signals. Ghost detecting circuitry which differentiates the training signal, for example, produces pulses corresponding to ghost images of the leading edge of vertical sync. This differentiation operation will also produce pulses corresponding to noise impulses in the training interval. Some of these noise pulses may be eliminated by conditioning the ghost detecting circuitry to ignore pulses having amplitudes greater than the sync-tip value (40 IRE). Since ghost signals occurring in the training interval are images of the leading edge of vertical sync, they should not have differential amplitudes greater than 40 IRE.

To distinguish between large amplitude impulse noise and ghost signals, the offset used for the ADC is desirably large enough to prevent the noise pulses from being clipped at or below the sync tip value. Since both positive and negative noise impulses may contaminate the video signals, it may be desirable to select an offset value to position the sync tip value in the center of the dynamic range of the ADC. In the present embodiment, for example, this offset value is 70 IRE.

Although the present embodiment of the invention develops an offset potential by adding current to the analog input signals, other means may be used to change the correspondence between the analog signals and the digital values developed by the ADC. For example, the potential reference used by the ADC to develop reference input signals for its comparators may be selectively shifted during the training interval to change the correspondence between the analog input values and digital output values by an amount equivalent to a desired offset potential.

Claims

1. A method of de-ghosting a video signal by means of signal offset circuitry, the circuitry comprising:

a source (10-14) for providing an analog video signal having a training signal component;

an analog-to-digital converter (26) coupled to said source for developing a digital signal representative of said analog video signal;

first means (16,18) coupled to said source for developing a control signal (T) corresponding to a predetermined interval; and

second means (20-24) coupled to said analog-to-digital converter and responsive to said control signal for changing the correspondence between said analog video signals and said digital signal during said predetermined interval,

characterized in that the method comprises selecting a portion of the vertical synchronizing interval of said analog video signal to represent the training signal component, said portion having a dynamic range normally extending from black level to synch tip level and which may include a ghost component which, when present, may tend to exceed the input signal dynamic range of said analog to digital converter (26) thus resulting in ghost amplitude clipping and a corresponding loss of ghost signal amplitude information;

producing, by said first means, said control signal only during said selected portion of said vertical synchronizing interval of said analog video signal;

altering said correspondence, with said second means (20,22,24), between said training signal level and said input signal range of said converter such that said analog to digital converter does not clip peaks of the ghost component of the training signal for preventing said loss of said ghost amplitude information; and

employing digital de-ghosting circuitry (28) connected to an output of said analog to digital converter (26) and responsive to said training signal having preserved ghost amplitude information for removing said ghost component from the active video portions of the digitized video signal provided by said analog to digital converter.

2. Signal offset circuitry for carrying out the method of claim 1, comprising:

a source (10-14) for providing an analog video signal having a training signal component;

an analog-to-digital converter (26) coupled to said source for developing a digital signal representative of said analog video signal;

first means (16,18) coupled to said source for developing a control signal (T) corresponding to a predetermined interval; and

second means (20-24) coupled to said analog-to-digital converter and responsive to

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said control signal for changing the correspondence between said analog video signals and said digital signal during said predetermined interval,

characterized in that said first means is operative to select as said training signal component in which the control signal is developed, a portion of vertical synchronizing interval of said analog video signal having a dynamic range normally extending from black level to synch tip level.

said second means (20,22,24), being responsive to said control signal to alter said correspondence between said training signal level and said input signal range of said converter such that said analog to digital converter does not clip peaks of the ghost component of the training signal for preventing loss of said ghost amplitude information; and including

digital de-ghosting circuitry (28) connected to an output of said analog to digital converter (26) and responsive to said training signal having preserved ghost amplitude information for removing said ghost component from the active video portions of the digitized video signal provided by said analog to digital converter.

3. Signal offset circuitry as recited in claim 2 characterized in that said second means comprises means (20,22,24) for adding a DC offset to said training signal prior to the application of said analog signal to said analog to digital converter.

4. Signal offset circuitry as recited in claim 3 characterized in that said second means is operative to select said DC offset to place said training signal approximately in the middle of the input signal range of said converter.

Patentansprüche

1. Verfahren zum Entfernen von Geisterbildern aus einem Videosignal ("deghosting") mittels einer Signal-Offset-Schaltung, welche aufweist:
   - eine Quelle (10 bis 14) zum Abgeben eines Analog-Videosignals mit einer Lernsignal-Komponente (training signal component);
   - einen Analog-Digital-Umsetzer (26), der mit der Quelle gekoppelt ist zum Abgeben eines digitalen Videosignals, welches das analoge Videosignal repräsentiert;
   - erste Mittel (16, 18), die mit der Quelle gekoppelt sind, um ein Steuersignal (T) zu erzeugen, welches mit einem vorbestimmten Intervall korrespondiert;
   - zweite Mittel (20 bis 24), die mit dem Analog-Digital-Umsetzer gekoppelt und abhängig von dem Steuersignal sind, zum Wechseln der Korrespondenz zwischen den Analog-Videosignalen und dem Digitalsignal während des vorbestimmten Intervalls;

   gekennzeichnet durch
   - Auswählen eines Abschnitts des Vertikal-Synchronintervalls des Analog-Videosignals, um die Lernsignal-Komponente zu repräsentieren, wobei der Abschnitt einen dynamischen Bereich (dynamic range) hat, der sich normalerweise vom Schwarzpegel (black level) zum Synchron-Spitzenpegel (synch tip level) erstreckt und der eine Geisterkomponente enthalten kann, die - wenn anwesend - dazu führen kann, daß der Dynamikbereich des Eingangssignales des Analog-Digital-Umsetzers (26) überschritten wird, was in einem Geister(signal)-Amplitudenbegrenzen (Clippen) und einem entsprechenden Verlust von Geistersignal-Amplitudeninformation resultiert;
   - Erzeugen des Steuersignals über die ersten Mittel nur während des ausgewählten Abschnittes des Vertikal-Synchronintervalls des Analog-Videosignals;
   - Wechseln der Korrespondenz über die zweiten Mittel (20, 22, 24) zwischen dem Lernsignal-Pegel und dem Eingangs-Signalbereich des Umsetzers, so daß der Analog-Digital-Umsetzer keine Spitzen der Geisterkomponente im Lernsignal begrenzt/abschneidet, um den Verlust der Geister-Amplitudeninformation zu vermeiden;
   - Verwenden von digitalen de-ghosting-Schaltkreisen (28), die mit einem Ausgang des Analog-Digital-Umsetzers (26) verbunden/gekoppelt sind und abhängig sind von dem Lernsignal mit bewahrter Geister-Amplitudeninformation, um die Geister-Komponente aus den aktiven Videoabschnitten des digitalisierten Videosignals zu entfernen, das von dem Analog-Digital-Umsetzer bereitgestellt wird.

2. Signal-Offset-Schaltung zur Durchführung des Verfahrens nach Anspruch 1,
   - mit einer Quelle (10 bis 14) zum Bereitstellen eines Analog-Videosignals mit Lernsignal-Komponente (training signal component);
   - mit einem Analog-Digital-Umsetzer (26), der mit der Quelle zum Bilden eines Di-

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gitalsignals gekoppelt ist, das für das Analog-Videosignal repräsentativ ist;

- mit ersten Mitteln (16, 18), die mit der Quelle gekoppelt sind zum Bilden eines Steuersignales (T), welches zu einem vorbestimmten Intervall korrespondiert;
- mit zweiten Mitteln (20 bis 24), die mit dem Analog-Digital-Umsetzer gekoppelt und abhängig von dem Steuersignal sind, zum Wechseln der Korrespondenz zwischen den Analog-Videosignalen und dem Digitalsignal während des vorbestimmten Intervalls;

dadurch gekennzeichnet,

- daß die ersten Mittel so arbeiten, daß sie als Lernsignal-Komponente (training signal component), in welcher das Kontrollsignal gebildet wird, einen Abschnitt des Vertikal-Synchronintervalles des Analog-Videosignals auswählen, welcher einen Dynamikbereich (dynamic range) aufweist, der normalerweise vom Schwarzpegel (black level) zum Synchron-Spitzenpegel (synch tip level) reicht,
- daß die zweiten Mittel (20, 22, 24) von dem Steuersignal abhängig sind, um die Korrespondenz zwischen dem Lernsignalpegel und dem Eingangs-Signalbereich des Analog-Digital-Umsetzers so zu verändern, daß er die Spitzen der Geisterkomponente des Lernsignals nicht abschneidet (begrenzt), um einen Verlust an Geister-Amplitudeninformation zu vermeiden;
- daß eine de-ghosting Schaltung (28) vorgesehen ist, die mit einem Ausgang des Analog-Digital-Umsetzers (26) gekoppelt ist und von dem Lernsignal abhängig ist, das die bewahrte Geister-Amplitudeninformation aufweist, um die Geisterkomponente aus den aktiven Videoabschnitten des digitalisierten Videosignals zu entfernen, das von dem Analog-Digital-Umsetzer bereitgestellt wird.

3. Signal-Offset-Schaltung nach Anspruch 2, **dadurch gekennzeichnet,**
   - daß die zweiten Mittel Mittel (20, 22, 24) aufweisen, um einen DC-Offset zu dem Lernsignal zu addieren, und zwar vor dem Zuführen (Anlegen) des Analogsignals an den Analog-Digital-Umsetzer.

4. Signal-Offset-Schaltung nach Anspruch 3, **dadurch gekennzeichnet,**
   - daß die zweiten Mittel so eingerichtet sind, daß sie den DC-Offset so wählen, daß das Lernsignal etwa in die Mitte des Eingangs-Signalbereichs (signal range) des Wandlers gelegt wird.

Revendications

1. Procédé d'enlèvement d'un signal vidéo fantôme à l'aide d'un circuit de décalage de signaux, le circuit comprenant :

une source (10-14) pour fournir un signal vidéo analogique possédant une composante de signal d'instruction;

un convertisseur analogique-numérique (26) couplé à ladite source pour développer un signal numérique représentatif dudit signal vidéo analogique;

des premiers moyens (16-18) couplés à ladite source pour développer un signal de commande (T) correspondant à un intervalle prédéterminé ; et

des seconds moyens (20-24) couplés audit convertisseur analogique-numérique et sensibles audit signal de commande pour changer la correspondance entre lesdits signaux vidéo analogiques et ledit signal numérique pendant ledit intervalle prédéterminé,

caractérisé en ce que leprocédé comporte de sélectionner une partie de l'intervalle de synchronisation verticale dudit signal vidéo analogique pour représenter la composante de signal d'instruction, ladite partie comportant une gamme dynamique s'étendant normalement du niveau noir au niveau d'extrémité de synchronisation et qui peut inclure une composante fantôme qui, si présente, peut tendre à dépasser la gamme dynamique du signal d'entrée dudit convertisseur analogique-numérique (26) conduisant ainsi à un écrétage de l'amplitude fantôme et à une perte correspondante d'information d'amplitude du signal fantôme;

de produire, par lesdits premiers moyens, ledit signal de commande seulement pendant ladite partie sélectionnée de l'intervalle de synchronisation verticale dudit signal vidéo analogique;

de modifier ladite correspondance, avec lesdits seconds moyens (20,22,24), entre ledit niveau du signal d'instruction et ladite étendue du signal d'entrée dudit convertisseur de telle sorte que ledit convertisseur analogique-numérique n'écrête pas les pics de la composante fantôme du signal d'instruction pour éviter lesdites pertes de ladite information d'amplitude fantôme; et

d'employer le circuit d'enlèvement des images fantômes (28)connecté à une sortie dudit convertisseur analogique-numérique (26) et sensible audit signal d'instruction comportant une information d'amplitude de signal fan-

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tôme préservée pour enlever ladite composante fantôme des parties vidéo actives du signal vidéo numérisé fourni par ledit convertisseur analogique- numérique.

2. Circuit de décalage de signal pour réaliser le procédé selon la revendication 1, comprenant:

une source (10-14) pour fournir un signal vidéo analogique comportant une composante de signal d'instruction;

un convertisseur analogique-numérique (26) couplé à ladite source pour développer un signal numérique représentatif dudit signal vidéo analogique;

des premiers moyens (16-18) couplés à ladite source pour développer un signal de commande (T) correspondant à un intervalle prédéterminé ; et

des seconds moyens (20-24) couplés audit convertisseur analogique-numérique et sensibles audit signal de commande pour changer la correspondance entre lesdits signaux vidéo analogiques et ledit signal numérique pendant ledit intervalle prédéterminé,

caractérisé en ce que lesdits premiers moyens sont actifs pour sélectionner comme dite composante de signal d'instruction dans laquelle le signal de commande est développé, une partie d'intervalle de synchronisation verticale dudit signal vidéo analogique possédant une étendue dynamique s'étendant normalement du niveau du noir au niveau d'extrémité de synchronisation

lesdits seconds moyens (20,22,24) étant sensibles audit signal de commande pour modifier ladite correspondance entre ledit niveau de signal d'instruction et ladite étendue du signal d'entrée dudit convertisseur de telle sorte que ledit convertisseur analogique-numérique n'écrête pas les pics de la composante fantôme du signal d'instruction pour éviter la perte de ladite information du signal fantôme ; et incluant

un circuit d'enlèvement des images fantômes (28) connecté à une sortie dudit convertisseur analogique-numérique (26) et sensible audit signal d'instruction ayant préservé l'information d'amplitude de signal fantôme pour enlever ladite composante fantôme des parties vidéo actives du signal vidéo numérisé fourni par ledit convertisseur analogique-numérique.

3. Circuit de décalage de signal selon la revendication 2 caractérisé en ce que lesdits seconds moyens comprennent des moyens (20,22,24) pour ajouter un décalage en courant continu audit signal d'instruction avant l'application dudit signal analogique audit convertisseur analogique-numérique.

4. Circuit de décalage de signal selon la revendication 3 caractérisé en ce que lesdits seconds moyens fonctionnent pour sélectionner ledit décalage en courant continu afin de placer ledit signal d'instruction approximativement au milieu de l'étendue du signal d'entrée dudit convertisseur.

* C L M S *