

Description

The present invention relates to a video signal processing system for separating a chrominance and a luminance component from a composite video signal.

Video signal processing systems which use a comb filter to separate the luminance and chrominance components from a composite video signal may not achieve proper separation in the presence of vertical transitions. In such a situation, some brightness information may erroneously appear in the comb filtered chrominance signal (in addition to the low frequency vertical detail brightness information, which normally appears there.) In addition, some color-representative information may erroneously appear in the comb filtered luminance signal. The latter condition is manifested by a series of dots at the frequency of the color subcarrier along vertical transition, and is known as a hanging dot condition. If the erroneous information is not removed from the signals in which it appears and restored to the proper signal, an objectionable image will be reproduced.

Our European Patent Application serial number 86302844.5 (EP-A-0 201 227 published on 12.11.86) for "Hanging Dot Reduction System" filed April 16, 1986 (L. A. Harwood and K. A. Law discloses a system for detecting the presence of a vertical transition and correcting for the presence of objectionable hanging dots caused by the transition. Apparatus according to the above application detects vertical transitions by detecting the cross-correlation between the comb filtered luminance and chrominance signals. If the cross-correlation exceeds a predetermined level, it is assumed that some color representative information is in the comb filtered luminance signal, and processing is

erred to remove this information from the comb filtered luminance signal and restore it to the comb filtered chrominance signal. The system of the above-mentioned application does not detect the presence of complementary-color vertical transitions, however.

In an NTSC composite video signal, color representative information modulates a subcarrier in such a manner that the hue is represented by the phase of the subcarrier, and the saturation is represented by its amplitude. The frequency of the subcarrier is selected such that there is a 180° phase shift from one line to the next. A complementary-color vertical transition occurs when the color on one line causes the subcarrier to be modulated with a given amplitude and a phase of θ , while the color on the preceding line causes the subcarrier to be modulated with the same amplitude but a phase of $\theta + 180^\circ$. This, coupled with the normal 180° phase shift from one line to

the next, means that in the presence of a complementary-color vertical transition, the subcarrier for the adjacent lines is in-phase.

A comb filter uses the normal 180° phase shift from line-to-line to separate luminance and chrominance from the composite video signal. Composite video signals separated by one line period are added to generate a luminance signal and subtracted to generate a chrominance signal. The color information is assumed to be canceled from the summed (luminance) signal because of the 180° phase shift of the subcarrier from one line to the next.

In the case of a complementary-color vertical transition, however, the assumed cancellation does not take place. Indeed, where the transition is between complementary colors of equal saturation (resulting in equal subcarrier amplitudes) all of the color representative information appears in the summed comb filtered luminance signal output and the subtracted comb filtered chrominance signal output is zero, because the signals of the two lines are in-phase and of the same amplitude. If the comb filtered luminance signal, which contains the color representative information, is processed by the luminance processing channel in the normal manner, then the objectionable hanging dots will be displayed. It is desirable that complementary-color vertical transitions be detected and processing changed to eliminate objectionable effects of such a transition in a video signal processor having a comb filter.

A form of detector disclosed in US-A-4 241 363 while it can recognize certain types of vertical transitions that appropriately call for suppression of the high frequency portion of the comb filtered luminance signal, is subject to being "fooled" by a complementary-color vertical transition into erroneously determining that no such suppression is needed. The nature of the detector operation relies upon the presence of modulated color representative information in both outputs of the comb filter to indicate the need for suppression. The consequence of a complementary-color vertical transition is to place the modulated color representative information, in only one output, albeit the wrong (i.e., luminance) output. The detector consequently fails to recognize this transition as calling for the suppression action.

In an apparatus according to the principles of the present invention, a detecting means detects when the modulated color subcarrier exhibits the same phase on adjacent lines, to develop an indication of the occurrence of a complementary-color vertical transition. The comb filtered chrominance and luminance signals are coupled to respective luminance and chrominance processing channels. The frequency content of the luminance compo-

nent is altered in the presence of said indication of a complementary-color vertical transition so that the color representative information is excluded from the luminance processing channel. This prevents the occurrence of a display exhibiting a hanging dots condition.

In accordance with another aspect of the present invention, it has been determined that an accurate indication of the occurrence of a complementary-color vertical transition can be obtained by recognizing two conditions: (a) that there is a high correlation between the comb filtered luminance signal from the current line, and the comb filtered chrominance signal from the preceding line; and (b) that the signal in the frequency band potentially occupied by modulated color representative signals in the comb filtered luminance signal from the preceding line has a relatively low level.

Apparatus according to this aspect of the present invention detects the presence of a complementary-color vertical transition by detecting: cross-correlation between the comb filtered luminance signal from a given line and the comb filtered chrominance signal from the preceding line; and a relatively low-level comb filtered luminance signal from the preceding line. If these conditions are detected, then the color representative information, which is in the comb filtered luminance signal, is restored to the signal supplied to the chrominance processing channel, and the color representative information is eliminated from the signal supplied to the luminance processing channel.

A cross-correlator suitable for use in implementing the present invention includes two threshold detectors coupled to the two input signals. The threshold detectors produce a signal having a first state when the input signal exceeds a given threshold level, and a second state otherwise. A sequence generator is coupled to the threshold detectors and generates a predetermined pattern sequence in the presence of cross-correlation between the two input signals. A pattern detector produces a signal indicating the presence of the predetermined pattern and thus the presence of cross-correlation.

In accordance with the principles of a further aspect of the present invention, an adaptive threshold detector for multibit digital signals includes a plurality of OR gates. Each OR gate has inputs coupled to a different number of most significant bits of the input multibit digital signal. The outputs of the plurality of OR gates are coupled to respective inputs of a multiplexer. The multiplexer couples one of its inputs to an output under control of a controller which can select the optimum threshold level for the signal conditions.

In the drawings:

FIGURE 1 is a block diagram of a complementary-color vertical transition signal processor in accordance with the principles of the present invention;

FIGURE 2 is a block diagram of a complementary-color vertical transition detector which may be used in the processor illustrated in FIGURE 1;

FIGURE 3 is a block diagram of a delay circuit which may be used in the detector illustrated in FIGURE 2;

FIGURE 4 is a diagram partially in block diagram form and partially in logic diagram form of an alternative detector which may be used in the processor illustrated in FIGURE 1;

FIGURE 5 is a logic diagram of a threshold detector which may be used in a multibit digital implementation of detectors illustrated in FIGURES 2 and 4;

FIGURE 6 is a diagram partially in block diagram form and partially in logic diagram form of an adaptive threshold detector which may be used in a multibit digital implementation of the detectors illustrated in FIGURES 2 and 4; and

FIGURE 7 is a block diagram of a signal coupler which may be used in the processor illustrated in FIGURE 1.

In FIGURE 1, a source of video signal 5 supplies a video signal to a comb filter 10, and a complementary-color vertical transition detector 20. Comb filter 10 generates a luminance signal Y and a chrominance signal C. The comb filtered luminance Y and chrominance C signals are coupled to a signal coupling circuit 30. The complementary-color vertical transition detector 20 generates a control signal which is coupled to the signal coupling circuit 30. The signal coupling circuit 30 has a first output coupled to the luminance processing channel 40, and a second output coupled to the chrominance processing channel 50.

As described above, in the presence of a complementary-color vertical transition, the comb filtered luminance signal Y from comb filter 10 contains modulated color representative information. The complementary-color vertical transition detector 20 detects that the modulated subcarrier, carrying color representative information, has a given phase on a given line; and that it has the same phase on the preceding line. This is indicative of a complementary-color vertical transition, and a control signal is generated. The signal coupling circuit 30, in response to this control signal, restores the portion of the comb filtered luminance signal Y assumed to contain the modulated color representative information to the signal supplied to the chrominance processing channel 50. The signal coupling circuit also deletes this information from the signal supplied to the luminance processing

channel 40.

FIGURE 2 illustrates a complementary-color vertical transition detector 20 which may be used for the corresponding element in FIGURE 1. Bandpass filter 62 receives a video signal from the source of video signals 5 (of FIGURE 1). The output of bandpass filter 62 is coupled to a comb filter 10'. Bandpass filter 62 passes the portion of the video signal which normally contains modulated color representative information. Comb filter 10' produces bandpassed comb filtered luminance Y' and chrominance C' signals. (Alternatively, comb filter 10 of FIGURE 1 could supply comb filtered luminance Y and chrominance C signals to respective bandpass filters similar to bandpass filter 62. The outputs of these two bandpass filters would correspond to the output of comb filter 10' of FIGURE 2.) The bandpassed comb filtered luminance output Y' of comb filter 10' is coupled to one input of a multiplier 68, and the bandpassed comb filtered chrominance output of C' is coupled to delay circuit 66, which delays the input signal by one horizontal line period. The output of delay circuit 66 is coupled to another input of multiplier 68. The output of multiplier 68 is coupled to low pass filter 70. The output of low pass filter 70 is coupled to one input of comparator 72. A source of threshold voltage 74 is coupled to the other input of comparator 72. Comparator 72 and threshold voltage source 74 form a threshold detector 73.

The bandpassed comb filtered luminance output Y' of comb filter 10' is also coupled to a delay circuit 76 which delays the input signal by one horizontal line. The output of delay circuit 76 is coupled to one input of a comparator 80. A source of threshold voltage source 78 is coupled to the other input of comparator 80. Comparator 80 and threshold voltage source 78 form a threshold detector 77.

The output of threshold detector 73 is coupled to one input of an AND gate 82, and the output of threshold detector 77 is coupled to the other input of AND gate 82. The output of AND gate 82 is the control signal supplied to signal coupler 30 (of FIGURE 1).

In an NTSC video signal processing system, for example, the passband of bandpass filter 62 runs from approximately 3 MHz to 4 MHz. The bandpassed comb filtered chrominance signal C' contains only that portion of the comb filtered chrominance signal normally containing modulated color representative information, and excludes the majority of vertical detail luminance information. The bandpassed comb filtered luminance signal Y' contains those frequencies which contain modulated color representative information at a complementary-color vertical transition.

The output of delay circuit 66 is the bandpas-

sed comb filtered chrominance signal delayed by one horizontal line. In the presence of a complementary-color vertical transition, the signals at the Y' output of comb filter 10', and the output of delay circuit 66 will be in-phase and have the same amplitude, as described above. If each of these signals is assumed to be a sine wave then the output of multiplier 68 will be:

$$\sin(\omega t) \sin(\omega t) = \sin^2(\omega t) = \frac{1}{2} + \frac{1}{2} \cos(2\omega t) \quad (1)$$

Equation (1) shows that a DC term results which will pass through low pass filter 70 and trigger threshold detector 73.

The output of threshold detector 73 is a "1" when the input to comparator 72 from low pass filter 70 exceeds the threshold level supplied by threshold voltage source 74, and is a "0" otherwise. A "1" at the output of threshold detector 73 indicates that the cross-correlation between the bandpassed comb filtered luminance signal representing the present line and the bandpassed comb filtered chrominance signal representing the preceding line has exceeded the predetermined level.

The output of threshold detector 77 is a "1" when the input to comparator 80 from delay circuit 76 is below the threshold level supplied by threshold voltage source 78, and is a "0" otherwise. (This is the logical inverse of the normal operation of a threshold detector, and is signified by the small circle at the output of comparator 80, indicating a logic inversion.) A "1" at the output of threshold detector 77 indicates that the level of the bandpassed comb filtered luminance signal representing the preceding line is below a predetermined level.

The output of AND gate 82 is a "1" only if the signals supplied to both of its inputs are "1". This occurs when both the level of the cross-correlation between the bandpassed comb filtered luminance signal representing the present line and the bandpassed comb filtered chrominance signal representing the preceding line exceeds a first predetermined level; and the level of the bandpassed comb filtered luminance signal representing the preceding line is below a second predetermined level. Thus, the output of AND gate 82 is a "1" in the presence of a complementary-color vertical transition.

FIGURE 3 illustrates a delay circuit which may be used in the cross-correlator of FIGURE 2 to supply the delayed bandpassed comb filtered chrominance and luminance signals to multiplier 68 (which in FIGURE 2 is supplied by delay circuit 66) and to threshold detector 77 (which in FIGURE 2 is supplied by delay circuit 76) respectively. The luminance and chrominance outputs of comb filter 10' supply signals to first and second inputs of a first subtractor 75. The output of subtractor 75 is

coupled to the input of a delay circuit 83, a first input of a second subtractor 79, and a first input of an adder 81. The output of delay circuit 83 is coupled to a second input of subtractor 79, and a second input of adder 81. Delay circuit 83, subtractor 79 and adder 81 form a comb filter 84. The delayed bandpassed comb filtered chrominance signal is produced at the output of subtractor 79. This signal is supplied to multiplier 68 (of FIGURE 2). The delayed bandpassed comb filtered luminance signal is produced at the output of adder 81. This signal is supplied to threshold detector 77 (of FIGURE 2).

The outputs of a 1-H comb filter are as follows:

$$Y = \frac{1}{2} (L_2 + L_1) \quad (2)$$

$$C = \frac{1}{2} (L_2 - L_1) \quad (3)$$

where Y is the comb filtered luminance signal, C is the comb filtered chrominance signal, and L_1 and L_2 are the composite video signals for the first and second lines respective. From equations (2) and (3), it is seen that:

$$L_1 = Y - C \quad (4)$$

$$L_2 = Y + C \quad (5)$$

The output of the first subtractor 75 includes the combined luminance and chrominance components for the frequency band normally containing the modulated color representative information for the first line input to the comb filter. This signal is then delayed by delay circuit 83 for one line period. To recover the luminance and chrominance components, the delayed signal is comb filtered by the combination of delay circuit 83, second subtractor 79, and adder 81 forming comb filter 84. The output of subtractor 79 is the delayed comb filtered chrominance signal representing the preceding line. This component is supplied to multiplier 68 of FIGURE 2. The output of adder 81 is the delayed comb filtered luminance signal representing the preceding line. This component is supplied to threshold detector 77 of FIGURE 2.

FIGURE 4 illustrates an alternative detector 20 which may be used for the corresponding element in FIGURE 1. Elements similar to those in the detector of FIGURE 2 are numbered the same. Bandpass filter 62 supplies a bandpassed video signal to comb filter 10'. Comb filter 10' produces a bandpassed comb filtered luminance signal Y' and a bandpassed comb filtered chrominance signal C'. The bandpassed comb filtered luminance signal Y' is coupled to a first input terminal of a comparator 80'. A second input terminal of the comparator 80' is coupled to a source of threshold voltage 78'.

Comparator 80' and threshold voltage source 78' in combination form a first threshold detector 77'.

The bandpassed comb filtered chrominance signal C' is coupled to a first input terminal of a comparator 72'. A second input terminal of comparator 72' is coupled to a source of threshold voltage 74'. Comparator 72' and threshold voltage source 74' in combination form a second threshold detector 73'. Both threshold detectors 77' and 73' produce a "1" when the input signal exceeds the threshold level set by the threshold voltage source (78' or 74') and a "0" otherwise.

The output of threshold detector 77' is coupled to the input of an inverter 92, and a first input of AND gate 98. The output of inverter 92 is coupled to a first input of AND gate 94. The output of threshold detector 73' is coupled to the other input of AND gate 94. The output of AND gate 94 is coupled to a delay circuit 96. The output of delay circuit 96 is coupled to a second input of AND gate 98. Inverter 92, AND gate 94, delay circuit 96 and AND gate 98 in combination form a sequence generator 90. The output of AND gate 98 is a sequence of bilevel signals. In the presence of cross-correlation between the bandpassed comb filtered luminance signal from the present line and the bandpassed comb filtered chrominance signal from the preceding line, and a relatively low level bandpassed comb filtered luminance signal from the preceding line, AND gate 98 generates a sequence with a predetermined pattern, (discussed below).

The output of sequence generator 90 is coupled to a pattern detector 100. Pattern detector 100 will detect the predetermined pattern indicating the presence of a complementary-color vertical transition and produce a control signal indicating the presence of this pattern. This control signal is used to control the signal coupling circuit 30 (of FIGURE 1).

If the bandpassed comb filtered luminance signal supplied to threshold detector 77' has a relatively low level, the output of threshold detector 77' will be "0". The output of inverter 92 will be a "1" in such a case and will allow the signal from threshold detector 73' to pass into delay circuit 96. If, on the other hand, the bandpassed comb filtered luminance signal supplied to threshold detector 77' has a relatively high level, then the output of threshold detector 77' will be "1". The output of inverter 92 will be a "0" in such a case, and "0"s will be supplied by AND gate 94 to delay circuit 96. Only "0" will be supplied to AND gate 98 in this condition, and the predetermined pattern will not be produced, regardless of the output of the threshold detector 73'.

In the illustrated embodiment, both signals supplied to AND gate 98 (when enabled by the output

of inverter 92 being "1"), are at the color subcarrier frequency and in-phase; both signals simultaneously are "1" for one-half the period and "0" for the other half. The output of AND gate 98, thus, is a sequence of alternating "1"s and "0"s, each having a period of one-half the period of the color subcarrier. This is the predetermined pattern indicating the presence of a complementary-color vertical transition.

Examples of pattern detectors which may be used in the cross-correlator illustrated in FIGURE 4 are found in U.K. Patent Application 8618179 (GB-AB-2 178 544 published on 11.02.87) entitled "Digital Pulse Width Detector" filed July 25, 1986 (L. A. Harwood and R. A. Wargo); European Patent Application (EP-A-0 199 540 published on 29.10.86) 86302847.8 entitled "Duration Sensitive Signal Stretcher" filed April 16, 1986 (R. A. Wargo); and European Patent Application 302846.0 (EP-A-0 199 539 published on 29.10.86) entitled "Duration-sensitive Digital Signal Gate" filed April 16, 1986 (L.A. Harwood and K.A. Law). Each of these applications detects a known pattern of a given duration, and generates an output signal indicating the presence of this pattern. Other implementations of pattern detectors are known to those skilled in the art.

FIGURE 5 illustrates a fixed threshold detector which may be used in a multibit digital implementation of a threshold detector used in FIGURES 2 or 4. In such implementations OR gate 102 of FIGURE 5 replaces the comparators 72, 80, 72' and 80' and threshold voltage sources 74, 78', 74' and 78' of threshold detectors 73, 73', 77 and 77' of FIGURES 2 and 4. The input digital signal is contained on a plurality of signal lines. In the illustrated embodiment, there are eight digital signal lines. Of the digital signal lines, only a plurality of most significant bits are coupled to respective inputs of OR gate 102. In the illustrated embodiment, the three most significant bits are coupled to OR gate 102. The output of OR gate 102 is the signal indicating whether the input signal exceeds the threshold level.

If the digital signal is represented in eight-bit straight binary form, these bit positions represent 32, 64 and 128. Thus, only binary values greater than 32 out of a maximum of 255 will cause the output of the OR gate to become a "1". Different numbers of most significant bits may be coupled to the OR gate 102, resulting in different thresholds, as illustrated in phantom on FIGURE 5.

FIGURE 6 illustrates an adaptive threshold detector which may be used for a multibit digital implementation of the threshold detectors illustrated in FIGURES 2 and 4. The adaptive threshold detector illustrated in FIGURE 6 replaces the comparators 72, 80, 72' and 80' and threshold voltage

sources 74, 78, 74' and 78' of threshold detectors 73, 77, 73' and 77' of FIGURES 2 and 4. A plurality of OR gates 104 each has a different number of most significant bits of the input digital signal coupled to their inputs. For example, the top OR gate has only the most significant bit coupled to its input. (In this case, the OR gate could be replaced by a straight connection from input to output.) This OR gate responds only to digital signals greater than 128 out of 256. The bottom OR gate has the seven most significant bits coupled to its input, and responds to digital signals greater than 2 out of 256.

The outputs of the plurality of OR gates 104 are coupled to respective signal inputs of multiplexer (MUX) 106. The signal output of multiplexer 106 is coupled to one of the signal inputs in response to a selection signal supplied to the control input of multiplexer 106. The selection signal is supplied to multiplexer 106 from a control circuit 108. The signal output of multiplexer 106 is the signal indicating whether the input signal exceeds the currently selected threshold level.

The multiplexer 106 acts to connect a single OR gate of the plurality of OR gates 104 into the signal path. This allows the threshold to change, because each OR gate of the plurality 104 responds to a different predetermined threshold.

As one illustrative example, the control signal may relate to the signal-to-noise ratio of the composite video signal. The signal-to-noise ratio may, for example, be calculated by analyzing the noise in the composite signal during vertical blanking, when no video signal is present. If the signal-to-noise ratio is high (i.e. the noise is low) then the threshold may be set lower without danger of false triggering by noise pulses. If the signal-to-noise ratio is low (i.e. the noise is high) then the threshold must be set high to avoid false triggering by noise pulses.

As another illustrative example, the control signal may relate to the level of the chrominance signal relative to the luminance signal. In a video signal processing system, an automatic chrominance control (ACC) signal, derived from the amplitude of the color burst component, represents this relative level. If the chrominance signal is relatively high, then the threshold may be set higher. If the chrominance signal is relatively low, then the threshold may be set lower. The threshold, thus, tracks the relative strength of the chrominance component.

In addition, these two control schemes could be used in combination. If the signal-to-noise ratio is high, indicating a non-noisy signal, then the ACC based threshold control scheme is used. If the signal-to-noise ratio is low, indicating a noisy signal, then the threshold is set high regardless of the

relative level of the chrominance component.

These are some examples of possible sources of control signals. Other schemes are possible and are evident to one skilled in the art.

FIGURE 7 illustrates a signal coupling means 30 which may be used in the processor illustrated in FIGURE 1. Elements similar to those in FIGURE 1 are numbered the same. The comb filtered luminance signal is supplied to one input of an adder 110. The comb filtered chrominance signal is coupled to a vertical detail filter 112. The output of vertical detail filter 112 is coupled to the other input of adder 110. Vertical detail filter 112 passes that portion of the comb filtered chrominance signal which normally contains only low frequency luminance information, called vertical detail information.

The output of adder 110 is coupled to bandpass filter 111. Bandpass filter 111 passes that portion of the luminance signal which, in the presence of a complementary-color vertical transition, contains modulated color representative information. The output of bandpass filter 111 is coupled to one input of a subtractor 114. The output of adder 110 is coupled to the other input of subtractor 114. Subtractor 114 subtracts the output of bandpass filter 111 from the output of adder 110. The output of subtractor 114, in the presence of a complementary-color vertical transition, contains primarily luminance information and is substantially free of modulated color representative information.

The output of subtractor 114 is coupled to a first signal input of multiplexer 116. The output of adder 110 is coupled to a second signal input of multiplexer 116. A control input of multiplexer 116 receives a control signal, for example, from the detectors 20 illustrated in FIGURES 2 and 4 and described above. A signal output of multiplexer 116 is coupled to luminance processing channel 40.

The comb filtered chrominance signal C is also coupled to a bandpass filter 113. Bandpass filter 113 passes that portion of the comb filtered chrominance signal which normally contains only modulated color representative information.

The output of bandpass filter 113 is coupled to a first input of an adder 118, and the output of bandpass filter 111 is coupled to a second input of adder 118. In the presence of a complementary-color vertical transition, the output of adder 118 contains the modulated color representative information in the comb filtered chrominance signal, as passed by bandpass filter 113; plus the modulated color representative information from the comb filtered luminance signal as passed by bandpass filter 111. The output of adder 118 is coupled to a first signal input of multiplexer 120, and the output of bandpass filter 113 is coupled to a second signal input of multiplexer 120. A control input of mul-

tiplexer 120 also receives the control signal. The signal output of multiplexer 120 is coupled to the chrominance processing channel.

As discussed above, the bandpassed comb filtered chrominance and luminance signals required by the circuits illustrated in FIGURES 2 and 4 may be supplied from the outputs of bandpass filters 113 and 111 respectively.

When the control signal indicates the presence of a complementary-color vertical transition, the multiplexers 116 and 120 couple the output of subtractor 114 to the luminance processing channel 40 and the output of adder 118 to the chrominance processing channel 50 respectively. Otherwise, multiplexers 116 and 120 couple the output of adder 110 to the luminance processing channel 40 and the output of bandpass filter 113 to the chrominance processing channel 50, respectively. In this manner, any modulated color representative information in the comb filtered luminance signal in the presence of a complementary-color vertical transition is excluded from the signal supplied to the luminance processing channel 40, and is restored to the signal supplied to the chrominance processing channel 50.

It is to be understood that, unless specifically stated to the contrary, the circuits described above and illustrated in the drawings may be constructed in either continuous or sampled data form, and in the sampled data form, the circuits may be constructed in either analog or digital form.

Claims

1. A video signal processing system, including a source of composite video signals including a luminance signal component and a chrominance signal component, said chrominance signal component comprising a subcarrier subject to modulation by color-representative information in such a manner that the phase of the subcarrier represents hue and the amplitude of the subcarrier represents saturation of the colors of a scene, a comb filter responsive to signals from said source for producing comb filtered luminance and chrominance signals, respective luminance and chrominance processing channels, first coupling means for coupling said comb filtered luminance signal to said luminance processing channel, said first coupling means including means for selectably suppressing a high frequency portion of said comb filtered luminance signal, and second coupling means for coupling said comb filtered chrominance signal to said chrominance processing channel; characterized by:

control signal developing means for developing a control signal indicative of the occur-



relative level of the chrominance component.

These are some examples of possible sources of control signals. Other schemes are possible and are evident to one skilled in the art.

FIGURE 7 illustrates a signal coupling means 30 which may be used in the processor illustrated in FIGURE 1. Elements similar to those in FIGURE 1 are numbered the same. The comb filtered luminance signal is supplied to one input of an adder 110. The comb filtered chrominance signal is coupled to a vertical detail filter 112. The output of vertical detail filter 112 is coupled to the other input of adder 110. Vertical detail filter 112 passes that portion of the comb filtered chrominance signal which normally contains only low frequency luminance information, called vertical detail information.

The output of adder 110 is coupled to bandpass filter 111. Bandpass filter 111 passes that portion of the luminance signal which, in the presence of a complementary-color vertical transition, contains modulated color representative information. The output of bandpass filter 111 is coupled to one input of a subtractor 114. The output of adder 110 is coupled to the other input of subtractor 114. Subtractor 114 subtracts the output of bandpass filter 111 from the output of adder 110. The output of subtractor 114, in the presence of a complementary-color vertical transition, contains primarily luminance information and is substantially free of modulated color representative information.

The output of subtractor 114 is coupled to a first signal input of multiplexer 116. The output of adder 110 is coupled to a second signal input of multiplexer 116. A control input of multiplexer 116 receives a control signal, for example, from the detectors 20 illustrated in FIGURES 2 and 4 and described above. A signal output of multiplexer 116 is coupled to luminance processing channel 40.

The comb filtered chrominance signal C is also coupled to a bandpass filter 113. Bandpass filter 113 passes that portion of the comb filtered chrominance signal which normally contains only modulated color representative information.

The output of bandpass filter 113 is coupled to a first input of an adder 118, and the output of bandpass filter 111 is coupled to a second input of adder 118. In the presence of a complementary-color vertical transition, the output of adder 118 contains the modulated color representative information in the comb filtered chrominance signal, as passed by bandpass filter 113; plus the modulated color representative information from the comb filtered luminance signal as passed by bandpass filter 111. The output of adder 118 is coupled to a first signal input of multiplexer 120, and the output of bandpass filter 113 is coupled to a second signal input of multiplexer 120. A control input of mul-

tiplexer 120 also receives the control signal. The signal output of multiplexer 120 is coupled to the chrominance processing channel.

As discussed above, the bandpassed comb filtered chrominance and luminance signals required by the circuits illustrated in FIGURES 2 and 4 may be supplied from the outputs of bandpass filters 113 and 111 respectively.

When the control signal indicates the presence of a complementary-color vertical transition, the multiplexers 116 and 120 couple the output of subtractor 114 to the luminance processing channel 40 and the output of adder 118 to the chrominance processing channel 50 respectively. Otherwise, multiplexers 116 and 120 couple the output of adder 110 to the luminance processing channel 40 and the output of bandpass filter 113 to the chrominance processing channel 50, respectively. In this manner, any modulated color representative information in the comb filtered luminance signal in the presence of a complementary-color vertical transition is excluded from the signal supplied to the luminance processing channel 40, and is restored to the signal supplied to the chrominance processing channel 50.

It is to be understood that, unless specifically stated to the contrary, the circuits described above and illustrated in the drawings may be constructed in either continuous or sampled data form, and in the sampled data form, the circuits may be constructed in either analog or digital form.

Claims

1. A video signal processing system, including a source of composite video signals including a luminance signal component and a chrominance signal component, said chrominance signal component comprising a subcarrier subject to modulation by color-representative information in such a manner that the phase of the subcarrier represents hue and the amplitude of the subcarrier represents saturation of the colors of a scene, a comb filter responsive to signals from said source for producing comb filtered luminance and chrominance signals, respective luminance and chrominance processing channels, first coupling means for coupling said comb filtered luminance signal to said luminance processing channel, said first coupling means including means for selectively suppressing a high frequency portion of said comb filtered luminance signal, and second coupling means for coupling said comb filtered chrominance signal to said chrominance processing channel; characterized by:

control signal developing means for developing a control signal indicative of the occur-



- rence of a complementary-color vertical transition, said control signal developing means including means, responsive to signals from said source, for detecting when the subcarrier on successive lines has the same phase, and means for rendering said suppressing means responsive to said control signal.
2. The system of claim 1, wherein said detecting means is coupled to said source by said comb filter and is responsive to said comb filtered luminance and chrominance signals.
 3. The system of claim 2, wherein said detecting means comprises: a cross-correlator, including:
 - means for delaying at least said comb filtered chrominance signal by one horizontal line period;
 - a multiplier responsive to said delayed comb filtered chrominance signal and said comb filtered luminance signal;
 - a low pass filter responsive to said multiplier; and
 - a threshold detector having an input coupled to said low pass filter for signifying that the signal at said input exceeds a given threshold level.
 4. The system of Claim 3, wherein:
 - said delaying means also delays said comb filtered luminance signal by one horizontal line period; and said detecting means further comprises:
 - a second threshold detector having an input coupled to receive said delayed comb filtered luminance signal for signifying that the signal at said input is less than a second given threshold level; and
 - a logic circuit coupled to said first-mentioned and said second threshold detector for generating a control signal in response to the signs from said detectors.
 5. The system of Claim 3 wherein said delaying means comprises:
 - a first subtractor for subtracting said comb filtered chrominance signal from said comb filtered luminance signal; and
 - a comb filter for producing at respective outputs delayed comb filtered luminance and chrominance signals.
 6. The system of Claim 3, wherein said threshold detector comprises:
 - an adaptive threshold detector including a control input wherein said given threshold level varies in response to the signal at said control input.
 7. The system of Claim 6, wherein said adaptive threshold detector is responsive to the amplitude of the burst component of said video signal.
 8. The system of Claim 6 wherein said adaptive threshold detector is responsive to the signal-to-noise ratio of said video signal.
 9. The system of Claim 7, wherein said adaptive threshold detector is further responsive to the signal-to-noise ratio of said video signal.
 10. The system of Claim 6, wherein said system operates on a multibit digital signal, and said adaptive threshold detector comprises:
 - a plurality of OR gates each having a plurality of inputs respectively coupled to a different plurality of most significant bits of said multibit digital signal;
 - a multiplexer having a plurality of signal inputs coupled to respective OR gates, a control input, and a signal output, for coupling one of said signal inputs to said signal output responsive to the signal at said control input.
 11. The system of Claim 2, wherein said detecting means comprises a cross-correlator including:
 - first and second threshold detectors having respective inputs coupled to said comb filtered luminance and chrominance signal sources, and generating respective output signals having a first state when the signal at said input exceeds a given respective threshold level, and having a second state otherwise;
 - means responsive to said first and second threshold detectors for generating a sequence of signals having a known pattern in the presence of a complementary-color vertical transition; and
 - a pattern detector responsive to said sequence generating means for producing a signal indicating the presence of said known pattern in said sequence of signals.
 12. The system of Claim 11, wherein said sequence generator comprises:
 - an inverter coupled to said first threshold detector;
 - a first AND gate having a first input coupled to said inverter, a second input coupled to said second threshold detector, and an output;
 - a delay circuit coupled to the output of said first AND gate for delaying signals by one horizontal line period; and
 - a second AND gate having a first input coupled to said first threshold detector, a second input coupled to said delay circuit, and an



output at which said known pattern is produced in the presence of a complementary-color vertical transition.

13. The system of claim 1, wherein said suppressing means produces a signal containing information substantially exclusive of modulated color representative information in the presence of a complementary-color vertical transition; and

wherein said second coupling means includes:

combining means, responsive to said control signal and coupled to said sources of comb filtered luminance and chrominance signal, for selectably producing a signal containing modulated color representative information from said comb filtered luminance signal and information from said comb filtered chrominance signal, in the presence of a complementary-color vertical transition; and

means responsive to said detecting means for selectively coupling said luminance and chrominance processing channels to said first and second signal producing means respectively in the presence of said cross-correlation, and to said comb filtered luminance and chrominance signal sources otherwise.

14. The system of Claim 13, wherein said suppressing means comprises:

a bandpass filter having an input coupled to said source of comb filter luminance signal and an output, for passing the band of frequencies which normally contains modulated color representative information in the presence of a complementary-color vertical transition; and

a subtractor having a first input coupled to said source of comb filtered luminance signal, a second input coupled to said bandpass filter, and an output, for subtracting the signal at said second input from the signal at said first input.

15. The system of Claim 13, wherein said combining means comprises:

a first bandpass filter having an input coupled to said source of comb filtered luminance signal and an output, for passing the band of frequencies which normally contains modulated color representative information in the presence of a complementary-color vertical transition;

a second bandpass filter having an input coupled to said source of comb filtered chrominance signal and an output, for passing the band of frequencies which normally contains modulated color representative informa-

tion; and

an adder having first and second inputs coupled to said first and second bandpass filters respectively.

16. The system of Claim 13, wherein said first coupling means comprises:

a first multiplexer having a first signal input coupled to said suppressing means, a second signal input coupled to said source of comb filtered luminance signals, a control input coupled to said control signal developing means, and a signal output, for coupling said signal output to said first input in the presence of development of said control signal, and said second input otherwise; and

wherein said second coupling means comprises:

a second multiplexer having a first signal input coupled to said combining means, a second signal input coupled to said source of comb filtered chrominance signals, a control input coupled to said control signal developing means, and a signal output, for coupling said signal output to said first input in the presence of development of said control signal, and said second input otherwise.

Revendications

1. Système de traitement de signaux vidéo, comprenant une source de signaux vidéo composés incluant une composante de signal de luminance et une composante de signal de chrominance comprenant une sous-porteuse soumise à une modulation par une information représentative de la couleur de manière que la phase de la sous-porteuse représente la teinte et que l'amplitude de la sous-porteuse représente la saturation des couleurs d'une scène, un filtre à encoches agissant en réponse à des signaux provenant de ladite source pour produire des signaux de chrominance et de luminance filtrés en encoches, des canaux de traitement respectifs de luminance et de chrominance, des premiers moyens de couplage pour coupler ledit signal de luminance filtré en encoches au dit canal de traitement de luminance, lesdits premiers moyens de couplage incluant des moyens pour supprimer de façon sélective, une portion de haute fréquence dudit signal de luminance filtré en encoches, et des seconds moyens de couplage pour coupler ledit signal de chrominance filtré en encoches au dit canal de traitement de chrominance, caractérisé par :

- des moyens de développement de signaux de commande pour développer un



signal de commande indiquant la survenue d'une transition verticale de couleur supplémentaire, lesdits moyens de développement de signaux de commande comportant des moyens, agissant en réponse aux signaux de ladite source, pour détecter lorsque la sous-porteuse sur des lignes successives possède la même phase et,

- des moyens pour faire agir lesdits moyens de suppression en réponse au dit signal de commande.

2. Système selon la revendication 1, dans lequel lesdits moyens de détection sont couplés à ladite source par ledit filtre à encoches et ils agissent en réponse aux dits signaux de chrominance et de luminance filtrés en encoches.

Système selon la revendication 2, dans lequel lesdits moyens de détection comprenant un inter-corrélateur qui comporte :

- des moyens pour retarder d'une période de ligne horizontale au moins ledit signal de chrominance filtré en encoches ;
- un multiplicateur agissant en réponse au dit signal de chrominance retardé, filtré en encoches et au dit signal de luminance filtré en encoches ;
- un filtre passe-bas agissant en réponse au dit multiplicateur et,
- un détecteur de seuil possédant une entrée couplée au dit filtre passe-bas pour signifier que le signal à ladite entrée dépasse un niveau de seuil donné.

4. Système selon la revendication 3, dans lequel :
 - lesdits moyens de retard retardent également d'une période de ligne horizontale ledit signal de luminance filtré en encoches et lesdits moyens de détection comprennent en outre :
 - un second détecteur de seuil comportant une entrée couplée de manière à recevoir ledit signal de luminance filtré en encoches et retardé afin de signifier que le signal à ladite entrée est inférieur à un second niveau de seuil donné et,
 - un circuit logique couplé au premier mentionné et au second détecteur de seuil pour générer un signal de commande en réponse aux signes desdits détecteurs.

5. Système selon la revendication 3, dans lequel lesdits moyens de retard comprennent :
 - un premier soustracteur pour soustraire ledit signal de chrominance filtré en en-

coches au dit signal de luminance filtré en encoches et,

- un filtre à encoches pour produire des signaux de chrominance et de luminance filtrés en encoches et retardés aux sorties respectives.

6. Système selon la revendication 3, dans lequel ledit détecteur de seuil comprend :

- un détecteur de seuil adaptif, comportant une entrée de commande, dans lequel ledit niveau de seuil donné varie en réponse au signal de ladite entrée de commande.

7. Système selon la revendication 6, dans lequel ledit détecteur de seuil adaptif agit en réponse à l'amplitude de la composante d'impulsion dudit signal vidéo.

8. Système selon la revendication 6, dans lequel ledit détecteur de seuil adaptif agit en réponse au rapport signal/bruit dudit signal vidéo.

9. Système selon la revendication 7, dans lequel ledit détecteur de seuil adaptif agit en outre en réponse au rapport signal/bruit dudit signal vidéo.

10. Système selon la revendication 6, dans lequel ledit système fonctionne sur un signal numérique multibits et ledit détecteur de seuil adaptif comprend :

- une pluralité de grilles OU comportant chacune une pluralité d'entrées, respectivement couplées à une pluralité différente de bits les plus significatifs dudit signal numérique multibits ;
- un multiplexeur comportant une pluralité d'entrées de signaux couplées aux grilles OU respectives, une entrée de commande et une sortie de signal, pour coupler l'une desdites entrées de signal à ladite sortie de signal en réponse à ladite entrée de signal et à ladite entrée de commande.

11. Système selon la revendication 2, dans lequel lesdits moyens de détection comprennent un intercorrélateur comportant :

- des premier et second détecteurs de seuil ayant des entrées respectives couplées aux dites sources de signaux de chrominance et de luminance filtrés en encoches et générant des signaux de sortie respectifs ayant un premier état lorsque le signal à ladite entrée excède un niveau de seuil respectif donné et



- ayant autrement un second état ;
- des moyens agissant en réponse aux dits premier et second détecteurs de seuil pour générer une séquence de signaux présentant une configuration connue en présence d'une transition verticale de couleur complémentaire et,
 - un détecteur de configuration agissant en réponse aux dits moyens de génération de séquence pour produire un signal indiquant la présence de ladite configuration connue dans ladite séquence de signaux.
12. Système selon la revendication 11, dans lequel ledit générateur de fréquence comprend :
- un inverseur couplé au dit premier détecteur de seuil ;
 - une première grille ET ayant une première entrée couplée au dit inverseur, une seconde entrée couplée au dit second détecteur de seuil et une sortie ;
 - un circuit à retard couplé à ladite sortie de ladite première grille ET pour retarder des signaux d'une période de ligne horizontale et
 - une seconde grille ET ayant une première entrée couplée au dit premier détecteur de seuil, une seconde entrée couplée au dit circuit à retard et une sortie à laquelle ladite configuration connue est produite en présence d'une transition verticale de couleur complémentaire.
13. Système selon la revendication 1, dans lequel lesdits moyens de suppression produisent un signal contenant de l'information excluant essentiellement l'information représentative de la couleur modulée, en présence d'une transition verticale de couleur complémentaire et, dans lequel lesdits seconds moyens de couplage comprennent:
- des moyens de combinaison, agissant en réponse au dit signal de commande et qui sont couplés aux dites sources de signaux de chrominance et de luminance filtrés en encoches, pour produire de façon sélective un signal contenant de l'information représentant la couleur modulée à partir dudit signal de luminance filtré en encoches et de l'information à partir dudit signal de chrominance filtré en encoches, en présence d'une transition verticale de couleur complémentaire et,
 - des moyens agissant en réponse aux dits moyens de détection pour coupler sélectivement lesdits canaux de traitement de luminance et de chrominance aux dits premiers et seconds moyens de production de signaux respectivement en présence de ladite inter-corrélation et, autrement, aux dites sources de signaux de chrominance et de luminance filtrés en encoches.
14. Système selon la revendication 13, dans lequel lesdits moyens de suppression comprennent :
- un filtre passe-bande ayant une entrée couplée à ladite source de signaux de luminance filtrés en encoches et une sortie, pour laisser passer la bande de fréquences qui contient normalement de l'information représentant la couleur modulée en présence d'une transition verticale de couleur complémentaire et,
 - un soustracteur ayant une première entrée couplée à ladite source de signaux de luminance filtrés en encoches, une seconde entrée couplée au dit filtre passe-bande et une sortie, pour soustraire le signal à ladite seconde entrée du signal à ladite première entrée.
15. Système selon la revendication 13, dans lequel lesdits moyens de combinaison comprennent :
- un filtre passe-bande ayant une entrée couplée à ladite source de signaux de luminance filtrés en encoches et une sortie, pour laisser passer la bande de fréquences qui contient normalement de l'information représentative de la couleur modulée, en présence d'une transition verticale de couleur complémentaire ;
 - un second filtre passe-bande ayant une entrée couplée à ladite source de signaux de chrominance filtrés en encoches et une sortie, pour laisser passer la bande de fréquences qui contient normalement de l'information représentative de la couleur modulée et,
 - un additionneur ayant des première et seconde entrées couplées respectivement aux dits premier et second filtres passe-bande.
16. Système selon la revendication 13, dans lequel lesdits premiers moyens de couplage comprennent :
- un premier multiplexeur ayant une première entrée de signal couplée aux dits moyens de suppression, une seconde entrée de signal couplée à ladite source de signaux de luminance filtrés en encoches, une entrée de commande couplée aux dits moyens de développement de



signaux de commande et une sortie de signal, pour coupler ladite sortie de signal à ladite première entrée en présence du développement dudit signal de commande et sinon à ladite seconde entrée et, dans lequel lesdits seconds moyens de couplage comprennent:

- un second multiplexeur ayant une première entrée de signal couplée aux dits moyens de combinaison, une seconde entrée de signal couplée à ladite source de signaux de chrominance filtrés en encoches, une entrée de commande couplée aux dits moyens de développement de signaux de commande et une sortie de signal, pour coupler ladite sortie de signal à ladite première entrée en présence de développement dudit signal de commande et sinon à ladite seconde entrée.

Patentansprüche

1. Videosignalverarbeitendes System, enthaltend eine Quelle von Videosignalgemischen, die eine Leuchtdichtesignalkomponente und eine Farbartsignalkomponente enthalten, wobei die Farbartsignalkomponente einen Hilfsträger aufweist, der einer Modulation durch farbrepräsentative Information unterworfen ist, derart, daß die Phase des Hilfsträgers den Farbton und die Amplitude des Hilfsträgers die Sättigung der Farben einer Szene darstellen, ein auf Signale aus der Quelle ansprechendes Kammfilter zur Erzeugung kammgefilterter Leuchtdichte- und Farbartsignale, zugehörige Leuchtdichte- und Farbart-Verarbeitungskanäle, eine erste Koppereinrichtung zum Koppeln des kammgefilterten Leuchtdichtesignals auf den Leuchtdichte-Verarbeitungskanal und enthaltend eine Einrichtung zum wahlweisen Unterdrücken eines hochfrequenten Teils des kammgefilterten Leuchtdichtesignals, und eine zweite Koppereinrichtung zum Koppeln des kammgefilterten Farbartsignals auf den Farbart-Verarbeitungskanal, gekennzeichnet durch:

eine steuersignalbildende Einrichtung zur Bildung eines Steuersignals, welches das Auftreten eines Vertikalübergangs zu einer komplementären Farbe anzeigt, und enthaltend eine Einrichtung, die auf Signale aus der Quelle anspricht, um zu detektieren, wann der Hilfsträger in aufeinanderfolgenden Zeilen dieselbe Phase hat, und

eine Einrichtung, welche die Unterdrückungseinrichtung auf das Steuersignal ansprechend macht.

2. System nach Anspruch 1, worin die detektierende Einrichtung über das Kammfilter mit der Quelle gekoppelt ist und auf die kammgefilterten Leuchtdichte- und Farbartsignale anspricht.

3. System nach Anspruch 2, worin die detektierende Einrichtung folgendes aufweist: einen Kreuzkorrelator, enthaltend:

eine Einrichtung zum Verzögern mindestens des kammgefilterten Farbartsignals um eine Horizontalzeilenperiode;

einen Multiplizierer, der auf das verzögerte kammgefilterte Farbartsignal und auf das kammgefilterte Leuchtdichtesignal anspricht;

ein Tiefpaßfilter, das auf den Multiplizierer anspricht; und

einen Schwellendetektor, der einen mit dem Tiefpaßfilter gekoppelten Eingang hat, um anzuzeigen, daß das Signal an diesem Eingang einen gegebenen Schwellenwert übersteigt.

4. System nach Anspruch 3, worin:

die verzögernde Einrichtung auch das kammgefilterte Leuchtdichtesignal um eine Horizontalzeilenperiode verzögert und die detektierende Einrichtung ferner folgendes aufweist:

einen zweiten Schwellendetektor mit einem Eingang, der zum Empfang des verzögerten kammgefilterten Leuchtdichtesignals angeschlossen ist, um anzuzeigen, daß das Signal an diesem Eingang geringer ist als ein zweiter gegebener Schwellenwert; und

eine logische Schaltung, die mit dem ersterwähnten und dem zweiten Schwellendetektor gekoppelt ist, um ein Steuersignal in Ansprache auf die Vorzeichen aus den Detektoren zu erzeugen.

5. System nach Anspruch 3, worin die verzögernde Einrichtung folgendes aufweist:

einen ersten Subtrahierer zur Subtraktion des kammgefilterten Farbartsignals vom kammgefilterten Leuchtdichtesignal und

ein Kammfilter zur Erzeugung verzögerter kammgefilterter Leuchtdichte- und Farbartsignale an zugeordneten Ausgängen.

6. System nach Anspruch 3, worin der Schwellendetektor folgendem aufweist:

einen adaptiven Schwellendetektor, der einen Steuereingang hat, wobei sich der gegebene Schwellenwert in Ansprache auf das Signal an diesem Steuereingang ändert.

7. System nach Anspruch 6, worin der adaptive Schwellendetektor auf die Amplitude der Burstkomponente des Videosignals anspricht.



8. System nach Anspruch 6, worin der adaptive Schwellendetektor auf das Signal/Rausch-Verhältnis des Videosignals anspricht.

9. System nach Anspruch 7, worin der adaptive Schwellendetektor außerdem auf das Signal/Rausch-Verhältnis des Videosignals anspricht.

10. System nach Anspruch 6, wobei dieses System ein Mehrbit-Digitalsignal verarbeitet und der adaptive Schwellendetektor folgendes aufweist:

eine Vielzahl von ODER-Gliedern, deren jedes eine Vielzahl von Eingängen hat, die mit jeweils einer anderen Vielzahl höchstwertiger Bits des Mehrbit-Digitalsignals gekoppelt sind;

einen Multiplexer mit einer Vielzahl von Signaleingängen, deren jeder an ein jeweils zugeordnetes Exemplar der ODER-Glieder angeschlossen ist, und mit einem Steuereingang und einem Signalausgang, um einen der Signaleingänge, abhängig vom Signal am Steuereingang, mit dem Signalausgang zu koppeln.

11. System nach Anspruch 2, worin die detektierende Einrichtung einen Kreuzkorrelator aufweist, der folgendes enthält:

einen ersten und einen zweiten Schwellendetektor, deren einer einen mit der Quelle des kammgefilterten Leuchtdichtesignals gekoppelten Eingang und deren anderer einen mit der Quelle des Farbartsignal gekoppelten Eingang hat und die jeweils ein Ausgangssignal erzeugen, das einen ersten Zustand hat, wenn das Signal am betreffenden Eingang einen jeweils zugeordneten gegebenen Schwellenwert übersteigt, und das andernfalls einen zweiten Zustand hat;

eine Einrichtung, die auf den ersten und den zweiten Schwellendetektor anspricht, um eine Folge von Signalen zu erzeugen, die beim Vorhandensein eines Vertikalübergangs zu einer komplementären Farbe ein bekanntes Muster hat, und

einen Musterdetektor, der auf die die besagte Folge erzeugende Einrichtung anspricht, um ein Signal zu erzeugen, welches das Vorhandensein des bekannten Musters in der besagten Folge von Signalen anzeigt.

12. System nach Anspruch 11, worin der Folgegenerator folgendes aufweist:

einen mit dem ersten Schwellendetektor gekoppelten Inverter;

ein erstes UND-Glied, das einen an den Inverter angeschlossenen ersten Eingang und einen an den zweiten Schwellendetektor ange-

schlossenen zweiten Eingang und einen Ausgang hat;

eine mit dem Ausgang des ersten UND-Gliedes gekoppelte Verzögerungsschaltung zum Verzögern von Signalen um eine Horizontalzeilenperiode, und

ein zweites UND-Glied, das einen mit dem ersten Schwellendetektor gekoppelten ersten Eingang, einen mit der Verzögerungsschaltung gekoppelten zweiten Eingang und einen Ausgang hat, an dem das bekannte Muster erzeugt wird, wenn ein Vertikalübergang zu einer komplementären Farbe vorhanden ist.

13. System nach Anspruch 1, worin die Unterdrückungseinrichtung ein Signal mit einem Informationsinhalt erzeugt, der beim Vorhandensein eines Vertikalübergangs zu einer komplementären Farbe im wesentlichen keine farbrepräsentative Modulationsinformation enthält, und

worin die zweite Koppereinrichtung folgendes enthält:

eine Kombiniereinrichtung, die auf das Steuersignal anspricht und mit den Quellen der kammgefilterten Leuchtdichte- und Farbartsignale gekoppelt ist, um in wählbarer Weise ein Signal zu erzeugen, das beim Vorhandensein eines Vertikalübergangs zu einer komplementären Farbe farbrepräsentative Modulationsinformation aus dem kammgefilterten Leuchtdichtesignal und Information aus dem kammgefilterten Farbartsignal enthält, und

eine Einrichtung, die auf die detektierende Einrichtung anspricht, um die Leuchtdichte- und Farbarte-Verarbeitungskanäle wahlweise bei Vorhandensein der besagten Kreuzkorrelation mit der ersten bzw. der zweiten signalerzeugenden Einrichtung und andernfalls mit den Quellen der kammgefilterten Farbarte- und Leuchtdichtesignale zu koppeln.

14. System nach Anspruch 13, worin die Unterdrückungseinrichtung folgendes aufweist:

ein Bandpaßfilter, das einen mit der Quelle des kammgefilterten Leuchtdichtesignals gekoppelten Eingang und einen Ausgang hat, um das Frequenzband durchzulassen, das normalerweise beim Vorhandensein eines Vertikalübergangs zu einer komplementären Farbe farbrepräsentative Modulationsinformation enthält, und

einen Subtrahierer, der einen mit der Quelle des kammgefilterten Leuchtdichtesignals gekoppelten ersten Eingang und einen mit dem Bandpaßfilter gekoppelten zweiten Eingang und einen Ausgang hat, um das Signal am zweiten Eingang vom Signal am ersten Eingang zu subtrahieren.



15. System nach Anspruch 13, worin die Kombiniereinrichtung folgendes aufweist:

ein erstes Bandpaßfilter, das einen mit der Quelle des kammgefilterten Leuchtdichtesignals gekoppelten Eingang und einen Ausgang hat, um das Frequenzband durchzulassen, das normalerweise beim Vorhandensein eines Vertikalübergangs zu einer komplementären Farbe farbrepräsentative Modulationsinformation enthält;

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ein zweites Bandpaßfilter, das einen mit der Quelle des kammgefilterten Farbartsignals gekoppelten Eingang und einen Ausgang hat, um das Frequenzband durchzulassen, das normalerweise farbrepräsentative Modulationsinformation enthält, und

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einen Addierer, der einen mit dem ersten Bandpaßfilter gekoppelten ersten Eingang und einen mit dem zweiten Bandpaßfilter gekoppelten zweiten Eingang hat.

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16. System nach Anspruch 13, worin die erste Koppeleinrichtung folgendes aufweist:

einen ersten Multiplexer, der einen mit der Unterdrückungseinrichtung gekoppelten ersten Signaleingang, einen mit der Quelle der kammgefilterten Leuchtdichtesignale gekoppelten zweiten Eingang, einen mit der steuersignalbildenden Einrichtung gekoppelten steuereingang und einen Signalausgang hat, um den Signalausgang im Falle der Bildung des Steuersignals mit dem ersten Eingang und andernfalls mit dem zweiten Eingang zu koppeln, und

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worin die zweite Koppeleinrichtung folgendes aufweist:

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einen zweiten Multiplexer, der einen mit der Kombiniereinrichtung gekoppelten ersten Signaleingang, einen mit der Quelle der kammgefilterten Farbartsignale gekoppelten zweiten Signaleingang, einen mit der steuersignalbildenden Einrichtung gekoppelten Steuereingang und einen Signalausgang hat, um den Signalausgang im Falle der Bildung des Steuersignals mit dem ersten Eingang und andernfalls mit dem zweiten Eingang zu koppeln.

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