Description

The present invention relates generally to a ghost canceling system for a television signal. More particularly, the invention relates to a ghost canceling filter circuit for use in a ghost canceling system.

Generally, a television set receives through an antenna a television signal composed by multiplying a directly received signal and delay signals which reach the antenna through several reflecting routes in which the signals are reflected by neighboring geographical features, neighboring buildings, moving vehicles or the like. Due to such delay signals, generally, multiple images may be come out in some extent on the received picture. Such delay signals causing the multiple images are called "a ghost" and a phenomenon that large multiple images deteriorate a quality of the picture is called "a ghost obstacle".

Recently, there have been developed several conventional types of a ghost canceling system which canceles the above-described ghost. For example, there have been known conventional ghost canceling signal generation circuits for use in a ghost canceling filter circuit as shown in Figs. 1 and 2.

In a conventional ghost canceling signal generation circuit shown in Fig. 1 (and as disclosed in US-A-4 127 874), a video signal including a ghost is supplied through an input terminal 41 to a shift register 42 in which the video signal is arranged in series on time series. A tap gain control circuit 46 selects the largest tap gain from tap gains inputted through an input terminal 48 and outputs the tap gain to a plurality of multipliers 44. Simultaneously, the tap gain control circuit 46 controls a tap selection circuit 43 which supplies to the corresponding multipliers 44 the output of the respective shift register 42, which output conforms with delay information in the selected tap gain. All outputs of the multipliers 44 are added to one another by an adder 45, then the adder 45 outputs a ghost canceling signal to an output terminal 47.

On the other hand, in another conventional ghost canceling signal circuit shown in Fig. 2 (and as disclosed in GB-A-2 146 023, a video signal including a ghost is supplied to a plurality of variable delay lines 52 through an input terminal 51. A delay amount of the signal supplied to the variable delay lines 52 is controlled by a tap gain control circuit 55 in accordance with a tap gain supplied through an input terminal 57. Each output of the variable delay lines 52 is multiplied with a tap gain outputted from the tap gain control circuit 55. All the outputs of the multipliers 53 are added to one another by an adder 54 which outputs the added signal performing as a ghost canceling signal to an output terminal 56.

The conventional ghost canceling signal generation circuit shown in Fig. 1 is disadvantageous in that the circuit requires the shift registers 42 large in number and the corresponding output tap for a range of the ghost, the number of which may be larger than several hundreds. Further, the tap selection circuit 43 necessitates input taps the number of which is equal to that of the output tap of the shift registers 42. Hence, the components of the circuit are disadvantageously large in number and, therefore, the circuit may be intricate and a total cost for the circuit would be unduly disadvantageously increased.

On the other hand, the conventional ghost canceling signal generation circuit shown in Fig. 2 is so constructed that one variable delay line corresponds to one multiplier. Therefore, if there are tap gains arranged in series on time series the number of which gains is n, the circuit necessitates the corresponding delay lines the number of which is n, in spite of that an actual delay circuit may merely require a shift register having n stages. Thus, such a conventional ghost canceling signal generation circuit is disadvantageous in that a large number of components are necessary and, therefore, a total cost for assembling the circuit is unduly increased.

Accordingly, an object of the present invention is to eliminate the above-described problems accompanying the conventional ghost canceling signal generation circuits. More specifically, an object of the invention is to provide a ghost canceling filter circuit for use in a ghost canceling system which necessitates small number of components and total cost is lowered. This object is solved by the ghost canceling filter circuit of claim 1. Further advantageous features of the ghost canceling filter circuit are evident from the dependent claims.

The invention provides a ghost canceling filter circuit which has an adding means for adding a ghost canceling signal to a digital video signal thereby canceling ghost components of the video signal and a ghost canceling signal generation means for generating a ghost canceling signal in accordance with an output of the adding means. The ghost canceling signal generation means of the present invention comprises a variable delay filter means composed by parallely arranging a plurality of variable delay lines a delay amount of which is controlable from the outside and a transversal filter a filter coefficient of which is controlable, each of which transversal filter is connected in series to the corresponding variable delay line, and an adding means for adding all outputs of the variable delay filter means and for outputting a ghost canceling signal.

According to the present invention, in view of the fact that a plurality of tap ceofficient arranged in series on time series are necessary for canceling one ghost, one filter for canceling one ghost is formed by connecting in series one variable delay line to one transversal filter.

Further, in order to cancel a plurality of ghosts, the circuit of the present invention is provided with a plurality of combinations arranged in parallel of the

variable delay line and the transversal filter connected in series to the corresponding variable delay line. Then, all of the outputs of the filters are added to one another thereby producing a ghost canceling signal. In this structure, the small number of variable delay lines are necessitated and, therefore, the circuit can be made with simple in structure and low manufacturing cost.

Fig. 1 is a block diagram showing a conventional ghost canceling signal generation circuit.

Fig. 2 is a block diagram showing another conventional ghost canceling signal generation circuit.

Fig. 3 is a circuit diagram showing a ghost canceling filter circuit according to the present invention.

Fig. 4 is a block diagram showing a ghost canceling signal generation circuit of the present invention shown in Fig. 3.

Fig. 5 is a block diagram showing another arrangement of a ghost canceling signal generation circuit of the present invention shown in Fig. 3.

Fig. 6 illustrates a function of a tap gain control circuit shown in Figs. 4 and 5.

Fig. 7 is a block diagram illustrating one example of a transversal filter shown in Figs. 4 and 5.

The ghost canceling filter circuit shown in Fig. 3 includes input terminals 11 and 15, an adder 12, a ghost canceling signal generation circuit 13 and an output terminal 14.

A digital video signal supplied through the input terminal 11 is added to an output of the ghost canceling signal generation circuit 13 by the adder 12. The adder 12 outputs a signal in which the ghost components have been canceled. The output signal of the adder 12 is supplied both to the output terminal 14 and to the ghost canceling signal generation circuit 13. The ghost canceling signal generation circuit 13 supplies the ghost canceling signal to the adder 12 in accordance with a ghost canceling coefficient supplied through the input terminal 15 and with the output of the adder 12.

Fig. 4 is a block diagram showing a ghost canceling circuit 13 which is an essential part of a ghost canceling filter circuit shown in Fig. 3 according to the present invention.

The ghost canceling circuit shown in Fig. 4 includes input terminals 21 and 27, a plurality of variable delay lines 22, a plurality of transversal filters 23, an adder 24, a tap gain control circuit 25 and an output terminal 26.

The output of the adder 12 shown in Fig. 3 is supplied to each of the variable delay lines 22 through the input terminal 21. A delay amount of the variable delay lines 22 is controlled by a control signal outputted by the tap gain control circuit 25. A delayed signal, that is, an output of the variable delay line 22 is supplied to the corresponding transversal filter 23. A tap gain of each of the transversal filters 23 is controlled by the control signal of the tap gain control circuit 25. Each of the transversal filters 23 supplies to the adder 24 a canceling signal which is necessary to cancel one ghost. The adder 24 adds all of the outputs of the transversal filters 23 and supplies the ghost canceling signal to the output terminal 26.

The tap gain control circuit 25 divides a ghost canceling coefficient for every one ghost wave from the ghost canceling coefficient supplied through the input terminal 27. The tap gain control circuit 25 supplies a delay amount control signal and a tap gain control signal to each of the variable delay lines 22 and each of the transversal filters 23, respectively. That is, assuming that there are two ghost waves viewing from a front end of a vertical synchronizing signal, for example as shown in Fig. 6A, the ghost canceling coefficient has two peaks as shown in Fig. 6B. In this case, the tap gain control circuit 25 divides each ghost canceling coefficient shown in Fig. 6B into one delay amount and one tap gain for one ghost wave as shown in Fig. 6C. Then, the tap gain control circuit 25 outputs a control signal including these signals to the variable delay lines 22 and to the transversal filters 23 as a respective control signal.

Fig. 5 is a block diagram showing another arrangement of the ghost canceling circuit which is an essential part of a ghost canceling filter circuit of the present invention shown in Fig. 3.

The ghost canceling circuit shown in Fig. 5 includes input terminals 121 and 127, a plurality of variable delay lines 122, a plurality of transversal filters 123, an adder 124, a tap gain control circuit 125 and an output terminal 126.

The output of the adder 12 shown in Fig. 3 is supplied to the first variable delay lines 122a through the input terminal 121. An output of the first variable delay line 122a is supplied to a second variable delay line 121b. This connection continues until a variable delay line 121n. A delay amount of each of the variable delay lines 122 is controlled by a control signal including a delay amount control signal outputted from the tap gain control circuit 125. The delayed signal, that is, an output of each variable delay line 122 is supplied to the corresponding transversal filter 123. A tap gain of each of the transversal filters 123 is controlled by a control signal including a tap gain control signal outputted from the tap gain control circuit 125. Each transversal filter 123 outputs to the adder 124 a canceling signal of which is necessary to cancel one ghost. The adder 124 adds all the outputs of the transversal filters 123 and outputs a ghost canceling signal to the output terminal 126.

The tap gain control circuit 125 divides a ghost canceling coefficient for every one ghost wave from the ghost canceling coefficient supplied through the input terminal 127. The tap gain control circuit 125 outputs a delay amount control signal and a tap gain control signal to each of the variable delay lines 122 and each of the transversal filters 123, respectively.

Fig. 7 is a block diagram showing the transversal filter 23 (123) employed in the ghost canceling signal generation circuit 13 which is one of essential components of the ghost canceling filter circuit according to the present invention.

The transversal filter shown in Fig. 7 includes input terminals 31 and 36, a shift register 32, a plurality of multipliers 33, an adder 34 and an output terminal 35. Each output of the variable delay lines 22 (122) shown in Fig. 4 (5), respectively, is supplied to the shift register 32 through the input terminal 31. In the shift register 32, the output of the variable delay line 22 (122) is delayed by a delay amount of a sampling period on time series by a one sample delay circuit Z^{-1}. The delayed signals from the shift register 32 are supplied to corresponding multipliers 33. Each of the multipliers 33 inputs the control signal performing as a multiplying coefficient supplied from the tap gain control circuit 25 (125) described above through the input terminal 36. Each of the multipliers 33 multiplies the output of the shift register 32 with the multiplying coefficient and outputs a multiplied signal to the adder 34. Then, the adder 34 adds all the outputs of the multipliers 33 and outputs the added signal, that is, a ghost canceling signal for one ghost wave to the output terminal 35.

As described above, in the ghost canceling filter circuit according to the present invention, the ghost canceling signal generation circuit is composed by connecting in series a plurality of variable delay lines which are controllable from the outside in order to cancel one ghost wave to the corresponding transversal filters. Such a circuit is advantageous in that, in contrast to the conventional circuits, the circuit does not have to be provided with one variable delay line corresponding to one tap gain. Accordingly, the sufficient ghost cancel can be accomplished with a circuit simple in construction and low in manufacturing cost.

Claims

1. A ghost cancelling filter circuit, comprising:
   means (13) for generating a ghost cancelling signal;
   means (12) for adding said ghost cancelling signal to a digital video signal including a ghost;
   means for supplying the output of said adding means (12) to said ghost cancelling signal generating means (13); and
   means (22, 122) comprised in said ghost cancelling signal generating means (13) for delaying said ghost cancelling signal;
   characterised by
   transversal filter means for filtering (23, 123) the output of said delay means (22, 122), said transversal filter means (23, 123) being connected in series to said delay means (22, 122); and
   means (25, 125) for generating a ghost controlling coefficient for each ghost wave by dividing a ghost cancelling coefficient supplied through an input terminal (27) and for generating a signal for controlling a delay amount of said delay means (22, 122) and a tap gain of said transversal filter means (23, 123) therefrom.

2. The ghost cancelling filter circuit of claim 1, wherein said delay means comprises a plurality of variable delay lines (22, 122) arranged in parallel or in series and said filter means comprises a plurality of transversal filters (23, 123), each transversal filter having an input connected to a corresponding output of said delay lines (22, 122).

3. The ghost cancelling filter circuit of claim 2, further comprising means (24) for adding all the outputs of said plurality of transversal filters (23) thereby outputting (26) said ghost cancelling signal.

4. The ghost cancelling filter circuit of claim 2 or 3, wherein said variable delay lines (22) and said transversal filters (23) are controllable from the outside.

5. The ghost cancelling filter circuit of one of the preceding claims, wherein each filtering means (23, 123) comprises an input terminal (31) for recovering an output from a corresponding variable delay means (22, 122), a plurality (32) of one sample delay circuits Z^{-1}, connected together in series, a first of said sample delay circuits connected to receive a signal from said input terminal (31), a plurality of multipliers (33), each connected to an output of a corresponding sample delay circuit and responsive to a tap gain coefficient supplied from a control means (25) to a control terminal (36), an adder (34), for adding all the outputs of said multipliers (33), and for providing a ghost cancelling signal for one ghost wave output signal to an output terminal (35).

Patentansprüche

1. Filterschaltung zur Geisterbildauslöschung, mit:
   Mitteln (13) zur Erzeugung eines Signals zur Geisterbildauslöschung;
   Mitteln (12) zum Addieren des Signals zur Geisterbildauslöschung zu einem digitalen Videosignal, welches ein Geisterbild enthält;
   Mitteln zum Zuführen des Ausgangs der Addiermittel (12) an die Mittel (13) zur Erzeugung

* C L M S *

Fig. 7 is a block diagram showing the transversal filter 23 (123) employed in the ghost canceling signal generation circuit 13 which is one of essential components of the ghost canceling filter circuit according to the present invention.

The transversal filter shown in Fig. 7 includes input terminals 31 and 36, a shift register 32, a plurality of multipliers 33, an adder 34 and an output terminal 35. Each output of the variable delay lines 22 (122) shown in Fig. 4 (5), respectively, is supplied to the shift register 32 through the input terminal 31. In the shift register 32, the output of the variable delay line 22 (122) is delayed by a delay amount of a sampling period on time series by a one sample delay circuit Z^{-1}. The delayed signals from the shift register 32 are supplied to corresponding multipliers 33. Each of the multipliers 33 inputs the control signal performing as a multiplying coefficient supplied from the tap gain control circuit 25 (125) described above through the input terminal 36. Each of the multipliers 33 multiplies the output of the shift register 32 with the multiplying coefficient and outputs a multiplied signal to the adder 34. Then, the adder 34 adds all the outputs of the multipliers 33 and outputs the added signal, that is, a ghost canceling signal for one ghost wave to the output terminal 35.

As described above, in the ghost canceling filter circuit according to the present invention, the ghost canceling signal generation circuit is composed by connecting in series a plurality of variable delay lines which are controllable from the outside in order to cancel one ghost wave to the corresponding transversal filters. Such a circuit is advantageous in that, in contrast to the conventional circuits, the circuit does not have to be provided with one variable delay line corresponding to one tap gain. Accordingly, the sufficient ghost cancel can be accomplished with a circuit simple in construction and low in manufacturing cost.

Claims

1. A ghost cancelling filter circuit, comprising:
   means (13) for generating a ghost cancelling signal;
   means (12) for adding said ghost cancelling signal to a digital video signal including a ghost;
   means for supplying the output of said adding means (12) to said ghost cancelling signal generating means (13); and
   means (22, 122) comprised in said ghost cancelling signal generating means (13) for delaying said ghost cancelling signal;
   characterised by
   transversal filter means for filtering (23, 123) the output of said delay means (22, 122), said transversal filter means (23, 123) being connected in series to said delay means (22, 122); and
   means (25, 125) for generating a ghost controlling coefficient for each ghost wave by dividing a ghost cancelling coefficient supplied through an input terminal (27) and for generating a signal for controlling a delay amount of said delay means (22, 122) and a tap gain of said transversal filter means (23, 123) therefrom.

2. The ghost cancelling filter circuit of claim 1, wherein said delay means comprises a plurality of variable delay lines (22, 122) arranged in parallel or in series and said filter means comprises a plurality of transversal filters (23, 123), each transversal filter having an input connected to a corresponding output of said delay lines (22, 122).

3. The ghost cancelling filter circuit of claim 2, further comprising means (24) for adding all the outputs of said plurality of transversal filters (23) thereby outputting (26) said ghost cancelling signal.

4. The ghost cancelling filter circuit of claim 2 or 3, wherein said variable delay lines (22) and said transversal filters (23) are controllable from the outside.

5. The ghost cancelling filter circuit of one of the preceding claims, wherein each filtering means (23, 123) comprises an input terminal (31) for recovering an output from a corresponding variable delay means (22, 122), a plurality (32) of one sample delay circuits Z^{-1}, connected together in series, a first of said sample delay circuits connected to receive a signal from said input terminal (31), a plurality of multipliers (33), each connected to an output of a corresponding sample delay circuit and responsive to a tap gain coefficient supplied from a control means (25) to a control terminal (36), an adder (34), for adding all the outputs of said multipliers (33), and for providing a ghost cancelling signal for one ghost wave output signal to an output terminal (35).

Patentansprüche

1. Filterschaltung zur Geisterbildauslöschung, mit:
   Mitteln (13) zur Erzeugung eines Signals zur Geisterbildauslöschung;
   Mitteln (12) zum Addieren des Signals zur Geisterbildauslöschung zu einem digitalen Videosignal, welches ein Geisterbild enthält;
   Mitteln zum Zuführen des Ausgangs der Addiermittel (12) an die Mittel (13) zur Erzeugung

des Signals zur Geisterbildauslöschung; und

in den Mitteln (13) zur Erzeugung eines Signals zur Geisterbildauslöschung enthaltenen Mitteln (22, 122) zur Verzögerung des Signals zur Geisterbildauslöschung;

gekennzeichnet durch

Transversalfiltermittel (23, 123) zur Filterung des Ausganges der Verzögerungsmittel (22, 122), wobei die Transversalfiltermittel (23, 123) mit den Verzögerungsmitteln (22, 122) in Reihe geschaltet sind; und

Mittel (25, 125) zur Erzeugung eines Geisterbildsteuerkoeffizienten für jede Geisterbildwelle durch Teilen eines durch eine Eingangsklemme (27) gelieferten Geisterbildauslöschungskoeffizienten und zur Erzeugung eines Signals zur Steuerung einer Verzögerung der Verzögerungsmittel (22, 122) und einer Abgriffverstärkung ('tap gain') der Transversalfiltermittel (23, 123) davon.

2. Filterschaltung zur Geisterbildauslöschung gemäß Anspruch 1, bei der die Verzögerungsmittel eine Mehrzahl an parallel oder in Reihe angeordneten variablen Verzögerungsleitungen (22, 122) aufweisen und die Filtermittel eine Mehrzahl an Transversalfiltern (23, 123) aufweisen, wobei jeder Transversalfilter einen Eingang aufweist, welcher an einen entsprechenden Ausgang der Verzögerungsleitungen (22, 122) angeschlossen ist.

3. Filterschaltung zur Geisterbildauslöschung gemäß Anspruch 2, die des weiteren Mittel (24) zum Addieren aller Ausgänge der Mehrzahl an Transversalfiltern (23) und dadurch Ausgabe (26) des Signals zur Geisterbildauslöschung aufweist.

4. Filterschaltung zur Geisterbildauslöschung gemäß Anspruch 2 oder 3, bei der die variablen Verzögerungsleitungen (22) und die Transversalfilter (23) von außen kontrollierbar sind.

5. Filterschaltung zur Geisterbildauslöschung gemäß einem der vorhergehenden Ansprüche, bei der jedes Filtermittel (23, 123) eine Eingangsklemme (31) zur Wiedergewinnung eines Ausganges von einem entsprechenden variablen Verzögerungsmittel (22, 122), eine Mehrzahl (32) an in Reihe geschalteter Sample-Verzögerungsschaltungen Z^{-1}, wobei eine erste der Sample-Verzögerungsschaltungen so geschaltet ist, daß diese ein Signal von einer Eingangsklemme (31) erhält, eine Mehrzahl an Vervielfachern (33), von welchen jeder an einen Ausgang einer entsprechenden Sample-Verzögerungsschaltung angeschlossen ist und auf einen von einem Steuermittel (25) an eine Steuerklemme (36) gelieferten Abgriffverstärkungskoeffizienten anspricht, einen Addierer (34) zum Addieren aller Ausgänge der Vervielfacher (33) und zur Bereitstellung eines Signals zur Geisterbildauslöschung als ein Geisterbildwellenausgangssignal zu einer Ausgangsklemme (35) aufweist.

Revendications

1. Circuit filtrant de suppression d'images fantômes comportant :
un moyen (13) pour générer un signal de suppression d'images fantômes;
un moyen (12) pour ajouter ledit signal de suppression d'images fantômes à un signal vidéo numérique comportant une image fantôme;
des moyens pour délivrer la sortie dudit moyen d'addition (12) audit moyen de génération de signaux de suppression d'images fantômes (13); et
un moyen (22, 122) compris dans ledit moyen de génération de signaux de suppression d'images fantômes (13) pour retarder ledit signal de suppression d'images fantômes;
caractérisé par
un moyen de filtrage transversal (23, 123) pour filtrer la sortie du moyen de retardement (22, 122), ledit moyen de filtrage transversal (23, 123) étant relié en série audit moyen de retardement (22, 122); et
un moyen (25, 125) pour générer un coefficient de contrôle d'images fantômes pour chaque onde fantôme en divisant un coefficient de suppression d'images fantômes délivré par l'intermédiaire d'un terminal d'entrée (27) et pour générer un signal pour contrôler à partir de là une quantité délai dudit moyen de retardement (22, 122) et un gain de prise (tap gain) dudit moyen de filtrage transversal (23, 123).

2. Circuit filtrant de suppression d'images fantômes selon la revendication 1, où ledit moyen de retardement comporte une pluralité de lignes à retard variable (22, 122) disposées en parallèle ou en série et ledit moyen de filtrage comporte une pluralité de filtres transversaux (23, 123), chaque filtre transversal disposant d'une entrée reliée à la sortie correspondante desdites lignes à retard (22, 122).

3. Circuit filtrant de suppression d'images fantômes selon la revendication 2, comportant également un moyen (24) pour additionner toutes les sorties de ladite pluralité de filtres transversaux (23) générant (26) ainsi ledit signal de suppression d'images fantômes.

4. Circuit filtrant de suppression d'images fantômes

* C L M S *

selon la revendication 2 ou 3, où lesdites lignes à retard variable (22) et lesdits filtres transversaux (23) sont contrôlables de l'extérieur.

5. Circuit filtrant de suppression d'images fantômes selon l'une des revendications précédentes, où chaque moyen de filtrage (23, 123) comporte un terminal d'entrée (31) pour récupérer une sortie du moyen de retardement variable correspondant (22, 122), une pluralité (32) de circuits de délai Z^{-1} à échantillon unique, reliés entre eux en série, un premier desdits circuits de délai d'échantillon étant relié de façon à recevoir un signal à partir dudit terminal d'entrée (31), une pluralité de multiplicateurs (33), chacun relié à une sortie d'un circuit de délai d'échantillon correspondant et sensible à un coefficient de gain de prise délivré à un terminal de contrôle (36) à partir d'un moyen de contrôle (25), un additionneur (34) pour additionner toutes les sorties desdits multiplicateurs (33) et pour délivrer un signal de suppression d'images fantômes pour un signal de sortie onde fantôme à un terminal de sortie (35).