System and apparatus for centering a light beam on an information track

This invention relates generally to systems for the reproduction of recorded information, such as video information recorded on a disc, and, more particularly, to systems for centering a beam of light or other radiation on an information track on such a disc.

Video and other types of information can be stored on a disc as a succession of light reflective and non-reflective regions along a spiral information track on the surface of a disc-shaped record carrier. In reproducing the video information, a video disc player employs an optical system for directing a radiant reading beam, such as a laser beam onto the information track, and for detecting a reflected beam indicative of the reflectivity of the disc surface scanned by the laser beam as the disc is rotated. In a disc player of the type with which the invention may be employed, the intensity of the reflected beam takes the form of a high frequency carrier signal which is frequency modulated by the video information.

In order to store a reasonably large amount of information on the disc, successive turns of the information track must be so closely spaced that even a slight degree of disc eccentricity would cause the beam to traverse a number of adjacent tracks on each revolution. Consequently, some means must be provided for applying transverse or radial corrections to the beam position, so that it substantially follows along the centre of the information track.

The correct reproduction of the information contained in the very fine track currently used on information discs with a track of perhaps 1 micron in width with a spacing of 1 micron between the tracks, has been found to require an exceptionally stable and reliable tracking system for keeping the beam accurately centered on the track. The difficulties are most noticeable when a mastering machine is used as a player for a specialised purpose for evaluating a devloped mastered disc, or for evaluating a stamper produced from a master matrix and to be used in mass production of information carrying discs. In such an application the playback function may only be used occasionally and drift derived from analogue multiplication circuits could cause errors or at least require readjustment of the system before each use.

The GB—A—1 483 161 describes a system which is for the same purpose as the present invention, and teaches the use of a dither signal from an oscillator which is added to an error signal for controlling the position of the radial transducer, the error signal being derived from a multiplier of the output from a photocell, and a signal from the oscillator by way of a filter.

That system although considered to be satisfactory when first developed, has been found in practice to be unreliable in certain applications, and to give rise to errors which tend to build up over a period of time. Work in finding the cause of these errors led to the discovery that the analogue multiplier described in GB—A—1483161 tends to produce drift over a period of time, and to necessitate critical circuit adjustments from time to time.

The signal multiplication referred to in GB—A—1483161 involves not only the relative phases of the signals to be multiplied, but also their amplitudes. That would not matter if the variation in amplitude was negligible or if consistency of tracking was not critical. However, it has now been discovered that those provisos do not apply, and that it is important to be independent of the amplitude of the dither signal, and to have very critical tracking.

Summary of the invention

The present invention resides in apparatus and a corresponding method for its use in a tracking system for centering a reading beam on an information track on a disc, for use in a disc player for deriving a modulated light signal from the track, comprising a first transducer for moving the beam radially; a second transducer for deriving a modulated light signal from energy reflected from the disc; means for generating an oscillatory dither signal for application to the first transducer means for obtaining an intermediate signal indicative of the effect of dither on said modulated light signal; means for deriving from said intermediate signal and from the dither signal an error signal for application to the first transducer; characterised by a band pass filter for obtaining the intermediate signal from the modulated light signal, and an inverter for deriving from the intermediate signal an inverted intermediate signal, and characterised in that the error signal deriving means includes means responsive to the instantaneous polarity of a signal derived from the dither signal, and arranged to determine whether components from the intermediate signal or components from the inverted intermediate signal are used in deriving the error signal.

In accordance with the best mode of the invention as presently contemplated, the means for generating the error signal comprises means for inverting the intermediate signal, and switch means operative to select the inverted or non-inverted forms of the intermediate signal. Operation of the switch means is controlled solely by the polarity of the dither signal, so that the intermediate signal is inverted on alternate half cycles of the dither signal. When the dither signal is in phase with the intermediate signal, the resulting error signal comprises a sequence of positive excursions, and when the dither signal is exactly out of phase with the intermediate signal, the resulting error signal comprises a sequence of negative excursions.

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In an alternative embodiment of the invention, the means for deriving an error signal includes first and second sample-and-hold means connected to sample said intermediate signal and its inverse, respectively; and pulse generation means responsive to the phase-corrected dither signal to generate a first train of pulses corresponding to positive peaks of said phase-corrected dither signal and a second train of pulses corresponding to negative peaks of said phase-corrected dither signal, said first and second trains of pulses being coupled to said first and second sample-and-hold means, respectively, whereby the outputs of said sample-and-hold means are summed together for supplying said error signal.

Consequently, the combined outputs of the sample-and-hold circuits are positive when the dither signal is in phase with the intermediate signal, and are negative when the dither signal is out of phase with the intermediate signal.

In both of the aforedescribed embodiments, the resulting error signal is low-pass filtered to obtain a signal indicative of deviation of the center path of the beam from the center of the information track, and then combined additively with the dither signal, before amplification and application to control the beam position. It will be appreciated that, since the transducer elements involved in controlling the beam position and in detecting the reflected beam together involve a substantial phase shift, phase shift compensation must be supplied at some point in the system, to ensure that the phase of the dither signal and the phase of the intermediate signal are meaningfully compared.

It will be appreciated from the foregoing that the present invention represents a significant advance in the field of video reproduction systems, as well as in data retrieval systems in general. In particular, the invention provides a simple and more reliable technique for ensuring that the beam used to read video information accurately follows the center of the information track on the disc. Other aspects and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings.

Brief description of the drawings

Figure 1 is a simplified diagrammatical view of an optical playback system for video disc recordings;

Figure 2 is a block diagram of a beam position servo control system utilizing the principles of the present invention;

Figure 3 is a block diagram showing an alternative form of a beam position servo control system utilizing the present invention;

Figure 4*a* is a fragmentary cross-sectional view of the surface of a recording disc taken along a radial line through the center of the disc;

Figure 4*b* is a graph showing the variation of disc reflectivity along a portion of a disc radius;

Figure 4*c* is a graph of the reflectivity signal corresponding to Figure 4*b* combined with the effect of a radial dither signal when the light beam is displaced radially to one side of the centre of the bumps 50 on the track.

Figure 4*d* is a graph of the intermediate signal obtained by bandpass filtering the signal of Figure 4*c* to eliminate very high frequency and very low frequency components.

Figure 4*e* is a graph of a constant-frequency, constant-amplitude dither signal, after appropriate phase correction for correlation with the intermediate signal of Figure 4*d*.

Figure 4*f* is a graph of the error signal derived from the intermediate signal of Figure 4*d* and the phase-corrected dither signal of Figure 4*e* and utilising the circuitry of the invention shown in Figure 2; and

Figure 4*g* is a graph of the error signal derived from the intermediate signal of Figure 4*d* and the phase-corrected dither signal of Figure 4*e* and utilising the circuitry of the invention shown in Figure 3.

As shown in the drawings for purposes of illustration, the present invention is concerned with a servo control system for maintaining a beam as nearly as possible in alignment with the centre of a recording track on a video recording disc. In the optical system of video reproduction with which the present invention is principally concerned, video information is stored on a disc in the form of raised bumps or lands on the disc surface, and is read by means of a light beam scanned across the surface. The bumps exhibit a lower total light reflectivity than the flat areas between the bumps. Information is encoded on the disc by forming a large number of bumps spaced along a spiral track on the disc surface, with the lengths of the bumps and the spaces between bumps being such that the resultant reflectivity signal has the form of a sinusoidal carrier, which is frequency modulated with the video information.

Since most discs, especially those produced for consumer use, will have relatively large eccentricities, some means must be provided for maintaining the reading beam centered on the information track as closely as possible. When only a single reading beam is utilised both for obtaining information recorded on the track and for obtaining an error signal for centering the beam, a radial oscillatory motion usually referred to as a dither, can be applied to the beam in order to determine in which direction a correction signal should be applied to keep the beam centered on the track. An error signal can be obtained by a process of combining the dither signal with an intermediate signal derived by filtering the reflectivity signal.

As shown in Figure 1, in a typical optical playback assembly a laser light source, indicated by reference numeral 10, directs light onto a disc surface 12. The reading beam from the laser is first reflected by a plane mirror 14, and then focused by a lens 16 onto a beam

splitting prism 18, the transmitted portion of the beam, indicated at 20, then being directed through a quarter-wave plate 22, and thence reflected from two successive fixed mirrors 24 and 26, and then from a movable mirror 28 which is pivotally mounted as shown at 30, and is adjustable in angle by means of a transducer 32. Finally, the beam is passed through an objective lens system 34 and focused on the disc 12. A beam reflected from the disc follows essentially the same path back to the beam splitting prism 18, at which point the reflected beam is further reflected by the prism to a light detector 36.

The detector 36 is a photoelectric transducer from which an output signal is transmitted to video signal processing circuitry, as indicated at 40, and to a beam position servo mechanism, over line 42. Typically the read beam is made to follow the spiral track by translating the entire optical playback assembly radially across the disc at a constant speed, with corrections for eccentricity and other tracking errors being made by means of the mirror positioning transducer 32, in accordance with a control signal supplied over line 44. The optical playback assembly may be supported at a constant distance above the disc by an air bearing, as indicated at 46.

Figure 4*b* shows how the reflectivity signal as the beam moves radially over a number of tracks, each of which has a bump at the line of radial movement, varies between a maximum value between tracks and a minimum value over the centre of a track. The approximately sinusoidal shape of this characteristic is derived from the fact that the bump at the centre of the track, indicated at 50, is less reflective than the wider flat area 52 between tracks, and the width of the reading beam is comparable in size to the width of the bump. It should be noted that the reflectivity signal of Figure 4*b* would be obtained only if the beam were allowed to traverse between tracks in an open-loop or uncontrolled fashion.

The beam is in fact wider than a bump, but its intensity falls off towards its sides, and the curve of Figure 4*b* is approximately correct, particularly near the track being followed, which is where the beam will be in practice. It will be appreciated that an actual reflectivity signal would contain a very high frequency carrier signal component due to the movement along the track. As will be later explained, this high frequency component is, in any event, filtered out and need not be further considered for purposes of explaining the invention.

In the type of control system with which the present invention is concerned, a dither signal, indicated diagrammatically in Figure 4*e*, is applied to the transducer 32 (Figure 1) controlling the radial position of the beam. It will be apparent that the effect of the dither signal on the reflectivity signal of Figure 4*b* is as shown in Figure 4*c*, in which it will be noted that the dither has a greater effect as the slope of the reflectivity curve steepens. At the relatively flat trough of the reflectivity curve, small radial oscillations have little or no effect on the reflectivity. Figure 4*c* shows the variation in the reflectivity due to the dither and to radial movement, if movement along the track is considered, but the high frequency information component is filtered out.

It will be apparent that, when the beam is on the left-hand side of a bump 50, as viewed in Figure 4*a* a dither motion to the left further increases the reflectivity, but when the beam is on the right-hand side of the pump, a dither motion to the left decreases reflectivity. It is, of course, this directional difference that permits the dither correction system to discriminate between position error on one side of the track as opposed to those on the other.

If the dither reflectivity signal is bandpass filtered to eliminate the low frequency component due to transitions from track to track, and the high frequency component due to the carrier frequency the result is the intermediate signal shown in Figure 4*d*.

Basically, the intermediate signal of Figure 4*d* contains only information indicative of the effect of dither on the reflectivity signal. It will be noted that the phase of this intermediate signal changes at points corresponding to the centres of the tracks and the centres of the spacings between tracks. In a known dither tracking system described in DE—A—2423074, the phase of the intermediate signal is compared with the phase of the dither signal.

In accordance with the present invention, an error signal is derived from the intermediate signal and the polarity of the dither signal, and is applied to the beam positioning transducer in combination with the dither signal. The manner in which the dither signal and the intermediate signal are combined will now be explained in detail with reference to Figures 2 and 3.

As shown in Figure 2, the beam positioning servo circuit comprises a sine wave oscillator 60 for generating the dither signal, a phase shifter 62, a switching multiplier 64, a compensation network 66, a bandpass filter 68, and a power amplifier 70. An output signal from the circuit is obtained from the power amplifier and supplied over line 44 to the beam positioning transducer 32. The light reflectivity signal is derived from the reflected light detector 36, and when received from a bump, includes an oscillatory component due to the dither signal as indicated diagrammatically at 33. The received signal is fed over line 42 to the bandpass filter. The bandpass filter 68 performs the filtering functions necessary to obtain the intermediate signal of Figure 4*d*, which is then transmitted over line 71 to the switching multiplier 64.

The switching multiplier 64 comprises an inverter 72 and a switch 74. The filtered signal from the bandpass filter 68 is connected both to the inverter 72 and to one pole of the switch 74,

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and the signal from the inverter 72 is connected to the other pole of the switch. In operation, the switch 74 selects one or other of the input signals, i.e. either the inverted or the non-inverted signal from the bandpass filter 68. A dither signal from the sine wave oscillator 60 is passed through the phase shifter 62, which is merely to compensate for phase shifts introduced in elements of the circuit between oscillator 60 and the switch 74, including the power amplifier 70, transducer 32, detector 36, and filter 68. As will be further explained, the dither signal is then used to control the position of the switch 74 in such a manner that the output of the switching multiplier on line 76 to the compensation circuit 66 comprises either the inverted or the non-inverted signal from the bandpass filter 68. Basically, the switch 74 is responsive to the instantaneous polarity of the phase-corrected dither signal, i.e. when the phase corrected dither signal is positive, the non-inverted intermediate signal on line 78 from the filter 68 is selected, and when the phase-corrected dither signal is negative, the inverted signal on line 80 from the inverter is selected.

It will be apparent that the resulting error signal output from the switching multiplier on line 76 is of the type illustrated in Figure 4*f*. When the beam is on the right hand side of a bump 50 or track, the intermediate signal is always in phase with the dither signal and the resulting error signal consists of only positive excursions. On the other hand, when the beam is on the left-hand side of a track, the intermediate signal of Figure 4d is out of phase with the dither signal, and only negative excursions of the error signal result, as shown in Figure 4f.

The resulting error signal of Figure 4f is next low-pass filtered in the compensation network 66 to produce essentially a sine-wave-shaped error signal, ninety degrees out of phase with the reflectivity signal of Figure 4b. This error signal is combined with the dither signal in a summing circuit 82 and applied to the power amplifier 70, and thence to the beam positioning transducer 32.

In accordance with the embodiment of the invention shown in Figure 3, the switching multiplier of Figure 2 is replaced by a sample-and-hold network 90. In this case, the output of the bandpass filter 68 is applied to a first sample-and-hold circuit 92 and through an inverter 72' to a second sample-and-hold circuit 94. The output of the phase shifter 62 is used to control a pulse generator 96 which generates one set of pulses corresponding to the positive peaks of the phase-corrected dither signal, supplied over line 98 to the first sample-and-hold circuit 92, and another set of pulses corresponding to the negative peaks of the phase-corrected dither signal, supplied over line 100 to the second sample-and-hold circuit 94. Again, it will be apparent that, when the beam is on the right-hand side of a track, the phase-corrected dither signal will be in phase with the intermediate signal of Figure 4*d* and only positive outputs from the sample and hold circuits will result. If the beam is positioned on the left-hand side of a track, negative outputs from the sample-and-hold circuits will result. As also shown in Figure 3, the outputs of the sample-and-hold circuits on lines 92 and 94 are combined in a summing circuit 102 whose output is fed over line 76' to the compensation network 66. The error signal output on line 76' from the sample-and-hold network 90 is basically as shown in Figure 4*g*, and this waveform is low-pass filtered in the compensation circuit 66 before application to the beam positioning transducer 32.

It will be appreciated from the foregoing that the present invention represents a significant advance in the field of dither tracking systems, especially as applied in video disc reproduction systems. In particular, the invention provides a simple and reliable technique for deriving a tracking error signal for application to a beam positioning transducer.

Claims

1. A tracking system for centering a reading beam on an information track on a disc, for use in a disc player for deriving a modulated light signal from the track, comprising a first transducer (32) for moving the beam radially; a second transducer (36) for deriving a modulated light signal from energy reflected from the disc; means (60) for generating an oscillatory dither signal for application to the first transducer means for obtaining an intermediate signal indicative of the effect of dither on said modulated light signal; means for deriving from said intermediate signal and from the dither signal an error signal for application to the first transducer; characterised by a band-pass filter (68) for obtaining the intermediate signal (Figure 4d) from the modulated light signal, and an inverter (72) for deriving from the intermediate signal an inverted intermediate signal, and characterised in that the error signal deriving means includes switching means (96 or 74) responsive to the instantaneous polarity of a signal (Figure 4e) derived from the dither signal, and arranged to determine whether components from the intermediate signal or components from the inverted intermediate signal are used in deriving the error signal (Figure 4f).

2. A tracking system as claimed in Claim 1 including a phase shifter (62) for compensating for phase changes derived from operation of the system.

3. A tracking system as claimed in Claim 1 or Claim 2 including a low-pass filter (66) of the error signal (Figure 4f).

4. A tracking system as claimed in any of the preceding claims including an adding circuit (82) for combining the dither signal with the

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and the signal from the inverter 72 is connected to the other pole of the switch. In operation, the switch 74 selects one or other of the input signals, i.e. either the inverted or the non-inverted signal from the bandpass filter 68. A dither signal from the sine wave oscillator 60 is passed through the phase shifter 62, which is merely to compensate for phase shifts introduced in elements of the circuit between oscillator 60 and the switch 74, including the power amplifier 70, transducer 32, detector 36, and filter 68. As will be further explained, the dither signal is then used to control the position of the switch 74 in such a manner that the output of the switching multiplier on line 76 to the compensation circuit 66 comprises either the inverted or the non-inverted signal from the bandpass filter 68. Basically, the switch 74 is responsive to the instantaneous polarity of the phase-corrected dither signal, i.e. when the phase corrected dither signal is positive, the non-inverted intermediate signal on line 78 from the filter 68 is selected, and when the phase-corrected dither signal is negative, the inverted signal on line 80 from the inverter is selected.

It will be apparent that the resulting error signal output from the switching multiplier on line 76 is of the type illustrated in Figure 4f. When the beam is on the right hand side of a bump 50 or track, the intermediate signal is always in phase with the dither signal and the resulting error signal consists of only positive excursions. On the other hand, when the beam is on the left-hand side of a track, the intermediate signal of Figure 4d is out of phase with the dither signal, and only negative excursions of the error signal result, as shown in Figure 4f.

The resulting error signal of Figure 4f is next low-pass filtered in the compensation network 66 to produce essentially a sine-wave-shaped error signal, ninety degrees out of phase with the reflectivity signal of Figure 4b. This error signal is combined with the dither signal in a summing circuit 82 and applied to the power amplifier 70, and thence to the beam positioning transducer 32.

In accordance with the embodiment of the invention shown in Figure 3, the switching multiplier of Figure 2 is replaced by a sample-and-hold network 90. In this case, the output of the bandpass filter 68 is applied to a first sample-and-hold circuit 92 and through an inverter 72' to a second sample-and-hold circuit 94. The output of the phase shifter 62 is used to control a pulse generator 96 which generates one set of pulses corresponding to the positive peaks of the phase-corrected dither signal, supplied over line 98 to the first sample-and-hold circuit 92, and another set of pulses corresponding to the negative peaks of the phase-corrected dither signal, supplied over line 100 to the second sample-and-hold circuit 94. Again, it will be apparent that, when the beam is on the right-hand side of a track, the phase-corrected dither signal will be in phase with the intermediate signal of Figure 4d and only positive outputs from the sample and hold circuits will result. If the beam is positioned on the left-hand side of a track, negative outputs from the sample-and-hold circuits will result. As also shown in Figure 3, the outputs of the sample-and-hold circuits on lines 92 and 94 are combined in a summing circuit 102 whose output is fed over line 76' to the compensation network 66. The error signal output on line 76' from the sample-and-hold network 90 is basically as shown in Figure 4g, and this waveform is low-pass filtered in the compensation circuit 66 before application to the beam positioning transducer 32.

It will be appreciated from the foregoing that the present invention represents a significant advance in the field of dither tracking systems, especially as applied in video disc reproduction systems. In particular, the invention provides a simple and reliable technique for deriving a tracking error signal for application to a beam positioning transducer.

Claims

1. A tracking system for centering a reading beam on an information track on a disc, for use in a disc player for deriving a modulated light signal from the track, comprising a first transducer (32) for moving the beam radially; a second transducer (36) for deriving a modulated light signal from energy reflected from the disc; means (60) for generating an oscillatory dither signal for application to the first transducer means for obtaining an intermediate signal indicative of the effect of dither on said modulated light signal; means for deriving from said intermediate signal and from the dither signal an error signal for application to the first transducer; characterised by a band-pass filter (68) for obtaining the intermediate signal (Figure 4d) from the modulated light signal, and an inverter (72) for deriving from the intermediate signal an inverted intermediate signal, and characterised in that the error signal deriving means includes switching means (96 or 74) responsive to the instantaneous polarity of a signal (Figure 4e) derived from the dither signal, and arranged to determine whether components from the intermediate signal or components from the inverted intermediate signal are used in deriving the error signal (Figure 4f).

2. A tracking system as claimed in Claim 1 including a phase shifter (62) for compensating for phase changes derived from operation of the system.

3. A tracking system as claimed in Claim 1 or Claim 2 including a low-pass filter (66) of the error signal (Figure 4f).

4. A tracking system as claimed in any of the preceding claims including an adding circuit (82) for combining the dither signal with the

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error signal (Figure 4g) for application to the first transducer.

5. A tracking system as claimed in any of the preceding claims in which the means for deriving an error signal includes first and second sample-and-hold means (93, 94) connected to sample said intermediate signal and its inverse, respectively; and pulse generation means (96) responsive to the phase-corrected dither signal to generate a first train of pulses (98) corresponding to positive peaks of said phase-corrected dither signal and a second train of pulses (100) corresponding to negative peaks of said phase-corrected dither signal, said first and second trains of pulses being coupled to said first and second sample-and-hold means, respectively, whereby the output of said sample-and-hold means are summed together for supplying said error signal (Figure 4f).

6. A method for controlling tracking in a disc player having a reading beam for deriving a modulated light signal from an information track on the disc, to centre the beam on the track as closely as possible; said method comprising the steps in which the beam is caused to dither radially by an oscillatory dither signal, an intermediate signal is obtained indicative of the effect of the dither signal on the modulated light signal; and an error signal is derived from the intermediate signal and from the dither signal and is used to control the mean radial beam position; characterised in that the modulated light signal is bandpass filtered to obtain the intermediate signal, an inverted intermediate signal is derived from the intermediate signal, and the error signal is derived from components of the intermediate signal and components from the inverted intermediate signal determined in dependence on the instantaneous polarity of a signal derived from the dither signal.

7. A method as claimed in Claim 6 in which the dither signal is compensated in phase for phase shifts introduced in circuit components before its instantaneous polarity is used to determine whether the intermediate signal or the inverted intermediate signal is used for deriving the error signal.

8. A method as claimed in Claim 6 or Claim 7 in which the error signal is low-pass filtered before being used to control the mean radial beam position.

9. A method as claimed in any of Claims 6—8 in which the dither signal is added to the error signal to control the radial beam position.

10. A method as claimed in any of Claims 6—9 in which to derive the error signal from the intermediate signal, enabling pulses dependent on the instantaneous polarity of the dither signal are used to control circuits carrying respectively the intermediate signal and the inverted intermediate signal.

Revendications

1. Système suiveur pour centrer un faisceau de lecture sur une piste d'information sur un disque, pour utilisation sans un tourne-disque pour dériver un signal de lumière modulé de la piste, comprenant un premier transducteur (32) pour déplacer radialement le faisceau; un second transducteur (36) pour dériver un signal modulé de lumière le l'énergie réfléchie du disque; un moyen (60) pour produire un signal oscillant de tremblotement pour application au premier moyen transducteur afin d'obtenir un signal intermédiaire indiquant l'effet du tremblotement sur ledit signal de lumière modulée; un moyen pour dériver dudit signal intermédiaire et du signal de tremblotement, un signal d'erreur pour application au premier transducteur; caractérisé par un filtre passe-bande (68) pour obtenir le signal intermédiaire (Fig. 4d) du signal de lumière modulée et un inverseur (72) pour dériver du signal intermédiaire un signal intermédiaire inversé et caractérisé en ce que le moyen dérivant le signal d'erreur comprend un moyen de commutation (96 ou 74) répondant à la polarité instantanée d'un signal (Fig. 4e) dérivé du signal de tremblotement, et agencé pour déterminer si les composants du signal intermédiaire ou les composants du signal intermédiaire inversé sont utilisés pour dériver le signal d'erreur (Fig. 4f).

2. Système suiveur selon la revendication 1 comprenant un déphaseur (62) pour compenser des changements de phase dérivés du fonctionnement du système.

3. Système suiveur selon l'une quelconque des revendications 1 ou 2 comprenant un filtre passe-bande (66) du signal d'erreur (Fig. 4f).

4. Système suiveur selon l'une quelconque des revendications précédentes comprenant un circuit d'addition (82) pour combiner le signal de tremblotement au signal d'erreur (Fig. 4g) pour application au premier transducteur.

5. Système suiveur selon l'une quelconque des revendications précédentes où le moyen pour dériver un signal d'erreur comprend des premier et second moyens d'échantillonnage et de maintien (93, 94) qui sont connectés pour échantillonner ledit signal intermédiaire et son inverse, respectivement; et un moyen générateur d'impulsions (96) répondant au signal de tremblotement dont la phase est corrigée pour produire un premier train d'impulsions (98) correspondant aux pics positifs dudit signal de tremblotement dont la phase est corrigée et un second train d'impulsions (100) correspondant aux pics négatifs dudit signal de tremblotement dont la phase est corrigée, lesdits premier et second trains d'impulsions étant couplés auxdits premier et second moyens d'échantillonnage et de maintien, respectivement, ainsi les sorties desdits moyens d'échantillonnage et de maintien sont additionnées pour produire ledit signal d'erreur (Fig. 4f).

6. Procédé pour contrôler la poursuite dans un tournedisque ayant un faisceau de lecture pour dériver un signal de lumière modulé d'une piste d'information sur le disque, pour centrer le

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faisceau sur la piste aussi précisément que possible; ledit procédé comprenant les étapes où le faisceau est forcé à trembloter radialement par un signal oscillant de tremblotement, un signal intermédiaire est obtenu indiquant l'effet du signal de tremblotement sur le signal de lumière modulé; et un signal d'erreur est dérivé du signal intermédiaire et du signal de tremblotement eton l'utilise pour contrôler la position radiale moyenne du faisceau; caractérisé en ce que le signal de lumière modulé est filtré en mode passe-bande pour obtenir le signal intermédiaire, un signal intermédiaire inversé est dérivé du signal intermédiaire et le signal d'erreur est dérivé de composantes du signal intermédiaire et de composantes du signal intermédiaire inversé déterminées en dépendance avec la polarité instantanée d'un signal dérivé du signal de tremblotement.

7. Procédé selon la revendication 6 caractérisé en ce que le signal de tremblotement est compensé en phase pour des déphasages introduits dans des composants de circuit avant que sa polarité instantanée ne soit utilisée pour déterminer si le signal intermédiaire ou le signal intermédiaire inversé est utilisé pour dériver le signal d'erreur.

8. Procédé selon la revendication 6 ou la revendication 7 où le signal d'erreur est filtré en mode passe-bas avant d'être utilisé pour contrôler la position radiale moyenne du faisceau.

9. Procédé selon l'une quelconque des revendications 6 à 8 où le signal de tremblotement est ajouté au signal d'erreur pour contrôler la position radiale du faisceau.

10. Procédé selon l'une quelconque des revendications 6 à 9 où pour dériver le signal d'erreur du signal intermédiaire, des impulsions de validation dépendant de la polarité instantanée du signal de tremblotement sont utilisées pour contrôler les circuits transmettant respectivement le signal intermédiaire et le signal intermédiaire inversé.

Patentansprüche

1. Spurfolgesystem zum Zentrieren eines Auslesestrahles auf eine Informationsspur auf einer Platte, zur Verwendung in einem Plattenspieler zur Ableitung eines modulierten Lichtsignals von der Spur, mit einem ersten Wandler (32) zum radialen Bewegen des Strahles; einem zweiten Wandler (36) zur Ableitung eines modulierten Lichtsignals von der von der Platte reflektierten Energie; einer Einrichtung (60) zur Erzeugung eines oszillierenden Zittersignals zur Anlegung an die erste Wandlereinrichtung, zur Erlangung eines die Wirkung des Zitterns auf das modulierte Lichtsignal anzeigenden Zwischensignals; einer Einrichtung zur Ableitung eines Fehlersignals aus dem Zwischensignal und aus dem Zittersignal, zur Anlegung an den ersten Wandler; gekennzeichnet durch ein Bandpaßfilter (68) zur Erlangung des Zwischensignals (Fig. 4d) aus dem modulierten Lichtsignal und einen Inverter (72) zur Ableitung eines invertierten Zwischensignals aus dem Zwischensignal; und dadurch gekennzeichnet, daß die Einrichtung zur Ableitung eines Fehlersignals eine Schalteinrichtung (96 oder 74) aufweist, die auf die momentane Polarität eines vom Zittersignal abgeleiteten Signals (Fig. 4e) anspricht und ein gerichtet ist, um festzulegen, ob Komponenten des Zwischensignals oder Komponenten des invertierten Zwischensignals zur Ableitung des Fehlersignals (Fig. 4f) verwendet werden.

2. Spurfolgesystem nach Anspruch 1, mit einem Phasenschieber (62) zur Kompensation von vom Betrieb Systems herstammenden Phasenänderungen.

3. Spurfolgesystem nach Anspruch 1 oder 2, mit einem Fehlersignal (Fig. 4f)-Tiefpaßfilter (66).

4. Spurfolgesystem nach einem der vorhergehenden Ansprüche, mit einer Additionsschaltung (82) zum Kombinieren des Zittersignals mit dem Fehlersignal (Fig. 4g), zur Anlegung an den ersten Wandler.

5. Spurfolgesystem nach einem der vorhergehenden Ansprüche, bei dem die Einrichtung zur Ableitung eines Fehlersignals estes und zweite, zum Abtasten des Zwischensignals bzw. des invertierten Zwischensignals angeschlossene Tastspeichermittel (93, 94) und Impulserzeugermittel (96) aufweist, die auf das phasenkorrigierte Zittersignal ansprechen, um eine erste Impulsreihe (98) entsprechend den positiven Spitzen des phasenkorrigierten Zittersignals und eine zweite Impulsreihe (100) entsprechend den negativen Spitzen des phasenkorrigierten Zittersignals zu erzeugen, wobei die ersten und zweiten Impulsreihen den ersten bzw. zweiten Tastspeichermitteln zugeführt werden, wodurch die Ausgänge der Tastspeichermittel zur Lieferung des Fehlersignals (Fig. 4f) zusammensummiert werden.

6. Verfahren zur Regelung der Spurverfolgung in einem Plattenspieler mit einem Auslesestrahl zum Ableiten eines modulierten Lichtsignals von einer Informationsspur auf der Platte, um den Strahl möglichst genau auf die Spur zu zentrieren; wobei das Verfahren die Schritte umfaßt, daß der Strahl durch ein oszillierendes Zittersignal zum Zittern in radialer Richtung veranlaßt wird, ein die Wirkung des Zittersignals auf das modulierte Lichtsignal anzeigendes Zwischensignal gewonnen wird; und ein Fehlersignal vom Zwischensignal und vom Zittersignal abgeleitet und zur Regelung der mittleren radialen Position des Strahles benutzt wird, dadurch gekennzeichnet, daß das modulierte Lichtsignal mit einem Bandpaß gefiltert wird, um das Zwischenspiel zu erhalten, ein invertiertes Zwischensignal vom Zwischensignal abgeleitet wird, und das Fehlersignal von Komponenten des Zwischensignals und Komponenten des invertierten Zwischensignals, gemäß Festlegung in Abhängigkeit von der

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momentanen Polarität eines vom Zittersignal abgeleiteten Signals, hergeleitet wird.

7. Verfahren nach Anspruch 6, bei dem das Zittersignal in der Phase hinsichtlicht Phasenverschiebungen kompensiert wird, die in Schaltungsteilen eingeführt werden, bevor seine momentane Polarität benutzt wird, um festzulegen, ob das Zwischensignal oder das invertierte Zwischensignal zur Herleitung des Fehlersignals benutzt wird.

8. Verfahren nach Anspruch 6 oder 7, bei dem das Fehlersignal mit einem Tiefpaß gefiltert wird, bevor es zur Regelung der mittleren radialen Position des Strahles benutzt wird.

9. Verfahren nach einem der Ansprüche 6 biss 8, bei dem das Zittersignal zum Fehlersignal addiert wird, um die radiale Position des Strahles zu regeln.

10. Verfahren nach einem der Ansprüche 6 bis 9, bei dem zur Herleitung des Fehlersignals vom Zwischensignal von der momentanen Polarität des Zittersignals abhängige Freigabeimpulse benutzt werden, um Schaltungen anzusteuern, die das Zwischensignal bzw. das invertierte Zwischensignal führen.

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