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Tracking control loop

The invention relates to a tracking control loop for a recording and/or reproduction equipment which scans a recording medium in non-contact making manner and which includes a fine and a coarse drive means for guiding a scanning device along the data tracks of the recording medium.

CD players are equipped with a tracking control loop of this type for example.

In a CD player, a light beam is focused onto the recording medium, the so-called compact disc, by means of a focusing control loop and is guided along the data tracks of the disc by means of the tracking control loop.

The tracking control loop is constructed from a coarse and a fine drive means which is attached to the coarse drive means. The coarse drive means may be implemented for example as a screw which is driven by a motor. The optical scanning device, which is usually built up from a plurality of lenses, a prismatic beam splitter and a photodetector, can thus be moved in a radial direction with respect to the disc by means of the coarse drive means.

The light beam can be moved by approximately ± 0.5 mm in the radial direction by means of the fine drive means. Consequently, because the regulating range of the fine drive means only comprises approximately ± 300 data tracks, the coarse drive means has to switched on from time to time when playing back a disc so that the light beam does not jerk away from the data track being scanned but rather, is always guided along the data track.

Now one disadvantage of a tracking control loop including a coarse and a fine drive means consists in that, when running, the coarse drive means generates mechanical oscillations which are transmitted to the optical scanning device. These oscillations are of course corrected by the focusing control

the fine drive means so that the scanning of the items is not interrupted due to a loss of focusing or of the track; if however, the CD player is subjected to external ions or shocks whilst the coarse drive means is switched as is frequently the case for a CD player built into a vehicle for example, the oscillations caused by the coarse drive and the external vibrations may be mutually reinforced. As a consequence thereof, there may be a loss of tracking; the beam will be jerked from the data track. One may even have a combination with a loss of focusing in adverse circumstances; the focusing control loop is then no longer capable of focusing the beam onto the disc.

Likewise, whilst the coarse drive means is running, there may be a loss of tracking and a loss of focusing if there are defects such as scratches or finger prints, present on the disc.

Consequently, the object of the invention is the achievement of a reliable scanning process for the items of data in the case of a recording and/or reproduction equipment which scans a recording medium in non-contact making manner especially when vibrations are occurring and there are defects on the recording medium.

This object is achieved by the invention in that the tracking error signal - the deviation of the instantaneous value from the reference value - is checked for errors and the coarse drive means is switched off if it is established that errors exist.

The invention is shown in

Figure 1 a first embodiment

Figure 2 a second embodiment of the invention

Figure 3 the tracking error signal.

In an optical reproduction equipment, e.g. in a CD player, a light beam scanning the items of data is focused onto the disc

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shaped recording medium, the so-called compact disc, by means of a focusing control loop.

If now, the light beam is jerked from the data track being scanned as a result of the equipment receiving an external shock for example, the tracking error signal increases.

The first embodiment shown in Figure 1 will now be explained.

The disc CD is driven by a motor M1. The coarse drive means is constructed from a motor M2 and a screw SP upon which the optical scanning device A is situated, the scanning device being movable in a radial direction with respect to the disc CD by means of the screw SP.

A detector H1 measures the level of the tracking error or focusing error signal. If the level of the tracking error or focusing error signal FE exceeds a predetermined threshold value W, the detector H1 sends a control signal S to the motor M2 of the coarse drive means, the signal preventing the coarse drive means from being switched on in the event of the coarse drive means being switched off, and switching the coarse drive means off in the event of the coarse drive means being switched on.

Due to these measures, which ensure that the coarse drive means remains switched off in such critical cases as where dirt or scratches on the disc or external vibrations are detrimental to a reliable scanning process, the reliability of the scanning process is no longer additionally reduced by oscillations caused by the coarse drive means. As soon as the disturbance caused by external shocks or by dirt and scratches on the disc has abated, the level of the HF oscillation in the tracking error and in the focusing error signal again rises. If it reaches the predetermined level then the detector H1 re-enables the coarse drive means M2, SP.

A second embodiment of the invention - illustrated in Figure 2 - provides for the coarse drive means being blocked only then, when both the level in the focusing error and also that in the

king error signal have fallen below predetermined threshold lues.

The focusing error signal FE is supplied to a first detector H1 and the tracking error signal TE to a second detector H2. The outputs of the two detectors H1 and H2 are connected to the inputs of an AND gate U whose output is connected to the motor M2 of the coarse drive means. In the first embodiment of the invention, an OR gate is provided instead of the AND gate.

Further measures for increasing the reliability of the scanning process provide for the gain of the fine drive means or the gain in the focusing control loop to be increased when the coarse drive means is switched on. The gain of the fine drive means or the gain in the focusing control loop may be controlled to be proportionate to the power taken by the coarse drive means for example. The gain of the two servo loops is then proportional to the current consumption of the motor M2 of the coarse drive means.

A further way of increasing the reliability of the scanning process provides for the gain of the fine drive means or the gain in the focusing control loop to be increased only during the start up and the braking phases of the coarse drive means. Moreover, the increase in the gain of the fine drive means or the gain in the focusing control loop may occur with a delay corresponding to the delay time of the coarse drive means.

Because the errors can be established for each revolution of the disc, the duration and the period of the errors can be ascertained. Once the period and the duration of the errors are settled, the time intervals for which the coarse drive means is to be switched off can then be predicted.

Whilst the coarse drive means is being switched on and off, compensating pulses are supplied to both of the servo loops in order to attenuate mechanical oscillations in the focusing control loop and in the tracking control loop which are caused

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by the inertial forces occurring when the coarse drive means is switched on and off.

The invention is suitable for recording and/or reproduction equipment which scan a recording medium in non-contact making manner and whose tracking control loop is constructed from a fine and a coarse drive means. CD players, video disc players, DRAW disc players and magneto-optic equipment may be cited as examples.

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Claims

1. Tracking control loop for a recording and/or reproduction equipment which scans a recording medium (CD) in non-contact making manner and which includes a fine and a coarse drive means (M2, SP) for guiding a scanning device (A) along the data tracks of the recording medium (CD), characterised in that, the tracking error signal (TE) is checked for errors and the coarse drive means (M2) is switched off if it is established that there are errors.

2. Tracking control loop in accordance with Claim 1, characterised in that, it is an optical recording and/or reproduction equipment in which a light beam (L) is focused onto the recording medium (CD), that the focusing error signal (FE) is checked for errors and the coarse drive means (M2) is switched off upon the occurrence of errors.

3. Tracking control loop in accordance with Claim 1 and 2, characterised in that, the coarse drive means (M2) is switched off if errors occur in the tracking error signal (TE) or in the focusing error signal (FE).

4. Tracking control loop in accordance with Claim 1 and 2, characterised in that, the coarse drive means (M2) is only switched off if errors occur both in the tracking error signal (TE) and in the focusing error signal (FE).

5. Tracking control loop in accordance with Claim 1 and 2, characterised in that, the tracking error signal (TE) or the focusing error signal (FE) is supplied to a detector (H1) whose output is connected to the coarse drive means (M2).

6. Tracking control loop in accordance with Claim 3, characterised in that, the focusing error signal (FE) is supplied to a first detector (H1) and the tracking error signal (TE) is supplied to a second detector (H2), that the outputs of the two detectors (H1, H2) are connected to the inputs of an OR

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gate (U) and that the output of the OR gate (U) is connected to the coarse drive means (M2).

7. Tracking control loop in accordance with Claim 4, characterised in that, the focusing error signal (FE) is supplied to a first detector (H1) and the tracking error signal (TE) is supplied to a second detector (H2), that the outputs of the two detectors (H1, H2) are connected to the inputs of an AND gate (U) and that the output of the AND gate (U) is connected to the coarse drive means (M2).

8. Tracking control loop in accordance with Claim 1, 2, 3, 4, 5, 6 or 7, characterised in that, the gain in the focusing control loop and/or the gain of the fine drive means is increased when the coarse drive means (M2) is switched on.

9. Tracking control loop in accordance with Claim 8, characterised in that, the gain is only increased during the start up and the braking phase of the coarse drive means (M2).

10. Tracking control loop in accordance with Claim 8 or 9, characterised in that, the gain is increased proportionately to the power consumption of the coarse drive means (M2).

11. Tracking control loop in accordance with Claim 8, 9 or 10, characterised in that, the gain is increased with a delay corresponding to the delay time of the coarse drive means (M2).

12. Tracking control loop in accordance with one or more of the preceding Claims, characterised in that, upon switching the coarse drive means on and off, compensating pulses are sent to the focusing control loop and/or the tracking control loop in order to attenuate mechanical oscillations which are caused by the inertial forces.

13. Tracking control loop in accordance with one or more of the preceding Claims, characterised in that, the errors are established for each revolution of the recording medium in order to ascertain the duration and the period of the errors and in

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order to determine the time intervals, during which the coarse drive means is to be switched off, from the duration and the period of the errors.

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