

Process for the shortening of the access time

The present invention relates to a process for shortening the access time at a reproduction apparatus, which reads data with constant tracking velocity without contact by means of a scanning device from a rotating disk, which is driven by an electric motor and whose speed of rotation is controlled by a synchronizing signal recorded on it.

There are reproduction apparatuses known, which scan data without contact from a disk, which is rotating with constant angular velocity. Besides this system, that is known in short as CAV-system - the abbreviation stands for constant angular velocity, there are reproducing systems, which scan a disk with a constant track velocity. These systems, among them e.g. CD-players, are called therefore constant-linear-velocity systems, abbreviated to CLV-systems. When scanning a disk from the inside to outside, starting from the innermost data track up to the outermost data track, the speed of rotation increases from data track to data track.

The control of the speed of rotation of the disk takes place during data reproduction by means of a synchronization signal, which is recorded on the disk. In a CD-player, a decoder decodes the data recorded according to eight to fourteen modulation, abbreviated to EFM. The synchronization signal for controlling the speed of rotation of the disk, which the decoder supplies, serves as control voltage for a phase control circuit having follow-up synchronization, which will in future be called its usual short-name PLL.

When jumping from one data track to an aimed-at track, the control circuit for the regulation of the speed of rotation of the disk is opened. At the same time the speed of rotation needed for the aimed-at track is calculated. While the light beams of the optical scanning device now jumps to the aimed-at track, the speed of rotation of the disk is regulated by a second control circuit to the number of

revolutions necessary for the scanning of the aimed-at track.

Because the momentary speed of rotation cannot be ascertained during track jumping with the aid of the synchronization signal recorded on the disk, the second control circuit for ascertaining the speed of rotation is equipped with a tacho-generator. When the light-beam arrives at the aimed-at track, the second control circuit has regulated the speed of rotation already to the necessary value for the aimed-at track. The second control circuit is again switched off, while at the same time the control loop of the first control circuit is closed in order to be able to regulate the speed of rotation of the disk again using the synchronization signal recorded on the latter.

Employing the measure, during the track jumping from a presently scanned data track to an aimed-at track, of regulating the speed of rotation of the disk by a second control circuit to the nominal value assigned to the aimed-at track, very short access times are achieved, because the disk rotates already at the correct speed when the light beam arrives at the aimed-at track. Apparatus which operates according to the above described method is known from EP-A-0123946.

A disadvantage is however, that a second control circuit having a tacho-generator is necessary.

Object of the invention is therefore to achieve short access times when track jumping without the need for a second control circuit for the regulation of the disk.

The invention solves this object in that before start of the reproduction of data the scanning device scans a selected data track, that meanwhile the electromotor is controlled by a pulse-width-modulated signal, whose pulse-width-rating is varied until the disk has reached the speed of rotation assigned to the selected

data track, that the pulse-width-ratio calculated for the selected data track is stored, that when jumping from one data track to an aimed-at track the control circuit is opened to control the speed of rotation, that from the memorized pulse-width-ratio the pulse-width-ratio assigned to an aimed-at track is calculated, that the electric motor is controlled by a signal having the calculated pulse-width-ratio and that the aimed-at track is reached the control circuit is closed again.

Using the example of a CD-player, the invention will be now explained.

Because the electric motor, which rotates the compact-disk, is controlled by a pulse-width-modulated signal, the speed of rotation of the disk depends on the pulse-width-ratio.

The invention starts from the perception, that for each speed of rotation a certain pulse-width-ratio is required, which can be calculated, when the pulse-width-ratio for one known data track is known.

After insertion of a disk therefore firstly a particular data track, e.g. the initial or the final track is scanned and using the synchronization signal recorded on the disk the speed of rotation is regulated to the correct value. The pulse-width-ratio of the signal adjusting itself at this speed of rotation, which is used to control the electric motor, is stored in a memory.

When track jumping from one data track to an aimed-at track, the control loop of the control circuit is opened in order to regulate the number of revolutions of the disk. From the stored pulse-width-ratio the pulse-width-ratio assigned to the aimed-at track is calculated. A control signal having the calculated pulse-width-ratio is now applied to the electric motor which rotates the disk in order to bring the disk to the speed of rotation required for the aimed-at track, the disk is therefore, as in the state of the art, already rotating with the correct speed. The

control circuit can now be closed again, so that the speed is regulated by means of the synchronization signals recorded on the disk.

The access time is when using the invention is just as short as according with the state of the art; however the invention does not require any additional components, such as a second control circuit including a tacho-generator.

Due to the fact that for each disk before reproduction starts the pulse-width-ratio is determined individually, different disk-sizes and different inertias for the individual disks do not matter.

As mentioned already, the pulse-width-ratio can be determined for the initial as well as for the final track of a compact disk. It is possible to determine the pulse-width-ratio for several known data tracks, e.g. initial and final tracks, and to store the calculated values. The stored values serve as basis for the calculation of the pulse-width-ratio necessary for the aimed-at track. The calculation of the pulse-width-ratio needed each time can be processed in a micro-processor, which can be found in each CD-player.

The invention is suited for recording and/or reproducing-sets, which scan a rotating disk without contact at constant linear tracking velocity. Examples are CD-players, video record players, DRAW-disk-players and magneto-optical sets.

CLAIMS

1. Process for shortening the access time at a reproduction apparatus, which reads data without contact at constant linear tracking velocity by means of a scanning device from a rotating disk, which is driven by an electric motor and whose speed of rotation is controlled by a synchronization signal recorded on the disk, characterised in that the scanning device scans before start of the data reproduction a selected data track, that meanwhile the electric motor is controlled by a pulse-width-modulated signal, whose pulse-width-ratio is varied until the disk has reached the speed of rotation assigned to the selected data track, that the pulse-width-ratio calculated for the selected data track is stored, that when jumping from one data track to an aimed-at track the control circuit is opened to control the speed of rotation, that from the memorized pulse-width-ratio the pulse-width-ratio assigned to an aimed-at track is calculated, that the electric motor is controlled by a signal having the calculated pulse-width-ratio and that upon reaching the aimed-at track the control circuit is closed again.
2. Process according to claim 1, characterized in that for a CD-player the pulse-width-ratio for the start track of the disk is determined and stored.
3. Process according to claim 1, characterised in that for a CD-player the pulse-width-ratio for the end track is determined and stored.
4. Process according to claim 1, characterized in that for several data tracks the pulse-width-ratios are determined and stored and that from the stored pulse-width-ratios the pulse-width-ratio assigned to the aimed-at track is calculated.
5. Process according to claim 4, characterized in that for a CD-player the pulse-width-ratio of the start and of the end track of the disk is determined and stored.