

Method and device for control

The present invention relates to a method for control according to the preamble of Claim 1, and a device suitable for carrying out the method according to the invention, in accordance with the preamble of the first device claim.

Control systems which determine manipulated variables on the basis of measured present values and predetermined desired values are generally known. Special applications of control systems, for example for so-called convergence correction, are also known.

Thus, for example in DE-A 39 36 789, a projection television set is presented in which a resistor is provided which is connected in series with deflection coils and across which there is a voltage drop U_a whose value is a function of a deflection current i_a . The voltage U_a is compared with a predetermined value and, depending on this comparison, manipulated variables are determined which influence the deflection current i_a .

Furthermore, DE-A 39 34 421 is known, in which a circuit for raster correction in a television set is presented. This circuit has the effect that a voltage, which can be picked off at a resistor connected in series with a deflection coil, is compared with a reference voltage and then driving signals for the deflection coils are corrected, if necessary. In this case, a differentiation is made between a dynamic correction for a multiplicity of points on one television picture and a static correction in order to stabilize an offset position.

However, the systems which are known from the prior art for convergence correction do not allow both a correction of optical deviations and a correction of electrical deviations with only one control loop.

It is the object of the present invention to implement a control which enables a correction of various disturbance variables and has a low memory requirement.

This object is achieved by means of a method

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according to Claim 1 and by means of a device, suitable for carrying out the method according to the invention, according to the first device claim.

Advantageous developments are characterized by the subclaims.

According to the invention, a present value, which is a measure of the effect of an actuating means (actuator), is first registered and then a control actuating signal is determined in a control mode by means of comparison with a predetermined desired value.

In addition, previously determined correction signals, which are used for the correction of disturbances which are not registered by the control process, are superimposed on the control actuating signal. In the case of the use of the control according to the invention in a convergence correction, these correction signals can, for example, register the influences of mechanical maladjustments or optical deviations in individual picture tubes. Moreover, picture distortions such as, for example, pin-cushion distortions, can be corrected by means of the previously determined correction signals. In order not to have to store correction values for each individual pixel, interpolation methods can also be used. How correction signals of this type are determined is known and it is not intended to be discussed further at this point.

As a result of the superimposition of the correction signals by the control actuating signal, a so-called actuating signal is generated which is used in an operating mode for driving the actuating means.

Although the invention is essentially described with reference to convergence correction, it should be pointed out that it is not restricted to this. Thus, for example, it is possible to correct signals which are generated by a CD player or signals which are used for controlling a receiving stage such as, for example, a radio-frequency tuner, in accordance with the present invention.

A first type of correction values is used in this



case, for example, for the correction of essentially constant offset variables of electrical components, and a second group of correction values is taken for the correction of variables which can change in the operation of the receiving stage. This second group of correction values can, for example, include those which are caused by thermal effects. The latter are preferably corrected, in a correction mode, at predetermined times at which any influence by a user or means which are connected downstream is slight.

In order to keep the control range as small as possible, in spite of a fine resolution, in a refinement of the invention further signals are superimposed on the control actuating signal. These additional signals have a value which is formed as a function of the total range of the correction signals and of the control actuating signal.

If it is possible to subdivide the previously determined correction signals into a first group, which corrects static errors such as, for example, mechanical or optical maladjustments of a picture tube, and into a second group, which corrects dynamic errors such as, for example, the said pincushion distortion, then in those cases in which the control actuating signal corrects common corrections for all pixels, this control actuating signal are able [sic] initially to be superimposed on the correction signals intended for the static corrections. The signal produced therefrom (also called the static actuating signal below) is subsequently superimposed on the dynamic manipulated variable, as a result of which the actuating signal is obtained.

The latter is based on the knowledge that a control device, in particular for convergence correction, contains a (standard) microprocessor, which produces the control actuating signal, and a second (specific) module which, for example, buffers correction values, effects the changeover between control mode and operating mode, conditions the actuating signals for driving the actuating means, etc. These two modules are normally connected



to a data line of limited capacity which, for example, can be configured as a serial data line.

If the static correction signals have the control actuating signal superimposed on them within the microprocessor, then, firstly, the static actuating signal, which comprises only a relatively small number of correction data, is conducted via a data line to the second module. The dynamic manipulated variable, which comprises a quite large number of correction data, but has constant values, can also be transmitted to the second module via this data line. Hence, as a whole, a lower data flow between the two modules is required if the control actuating signal has already been superimposed on the static manipulated variable within the microprocessor.

If two or more drive chains which in each case comprise, for example, digital/analog converters, amplifiers, etc., are used for driving the actuating means, in the case of each of these chains individual drift, for example because of temperature changes or ageing, is to be expected and the determination of control actuating signals and hence also of actuating signals is necessary for each of these chains.

In order to achieve a reduction in the necessary memory requirement and the necessary data line capacity, a subdivision can be carried out in the transmission of the actuating signals for the individual drive chains.

Firstly, a mean value of the two individual control actuating signals can be formed in the microprocessor and forwarded to the second module. This individual mean value, which changes in a similar way to the value of an individual control actuating signal, can be superimposed on the static actuating signal.

On the other hand, the differences between the individual control actuating signals and the mean value are formed and these differences are added to the dynamic correction signals and transmitted.

Further features, advantages and details of the invention are explained in the following exemplary



embodiments, with reference to the drawing, in which:

Figures 1 - 3: show various exemplary embodiments for convergence correction using a drive chain;

5 Figure 4: shows a further exemplary embodiment for convergence correction using two drive chains;

Figure 5: shows a further exemplary embodiment in which variables for driving a tuner are corrected.
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Before the description of the exemplary embodiments is gone into in more detail, it should be pointed out that the individual blocks shown in the figures are used only for the better understanding of the invention. Individual blocks or several of these blocks
15 are normally combined into units. The latter can be realized in integrated or hybrid technology or as a program-controlled microcomputer, for example as part of a program suitable for its control.

20 However, the elements which are contained in the individual stages can also be designed separately.

Figure 1 shows several blocks, of which a first block 10 represents a memory module, which has a first static memory (MS 1) 11 and a first dynamic memory (MD 1) 12, which can be configured, for example, as a so-called
25 EEPROM. A further block 13 is intended to symbolize a microprocessor module. The latter contains a second static memory (MS 2) 14 and a second dynamic memory (MD 2) 15, which are each connected on the input side to the corresponding first memories 11 and 12, respectively,
30 and emit their output signals Ks and Kd, respectively, to a first superimposition stage 16. In addition, the latter is fed with output signals Rs' from a first offset memory (MO 1) 17, which is fed with control actuating signals Rs
35 by a comparison stage 18.

This comparison stage 18 obtains its input signal I' from a flip-flop 19, which is part of a block 20 which is designated as special stage. In addition, the latter contains a second offset memory (MO 2) 21, which obtains



its data, which likewise correspond to the control actuating signal Rs, from the comparison stage 18 by means of a serial data line connecting the blocks 13 and 20, and forwards a signal Rs" to a first switching terminal of a switch 22. The latter and the flip-flop 19 are driven by an electronic controller (ECU) 23. The second switching input of the switch 22 is connected to the output of a correction memory (MK) 24, whose input signal comes from the first superimposition stage 16. The connection between the superimposition stage 16, which is part of the microprocessor 13, and the correction memory 24, which is part of the block 20, is implemented by means of a serial data line.

The switching output of the switch 22 leads to a digital/analog converter 25, whose output signal is forwarded to an amplifier 26, which is part of a block 27, which can be considered here as the external connection of the special stage. The output from the amplifier 26 is connected to a deflection coil 28 which, in this exemplary embodiment, serves as actuating means and is connected in series with a resistor 29, which leads to earth. Both terminals of this resistor 29 lead to a threshold value stage 30, which is a part of the special stage 20.

The function of the exemplary embodiment according to Figure 1 is described below.

Stored in the first static memory 11 and in the first dynamic memory 12 are correction values which have been determined previously, for example within the context of a production and balancing process, and are forwarded as correction signals Ks and Kd, respectively. In this case, the variables Ks from the memory 11 essentially take into account optical and mechanical deviations of a picture tube, which is not shown, and which is assigned to the deflection coil 28. The correction values which the first dynamic memory 12 contains essentially take into account picture distortion such as, for example, so-called pincushion distortion, which can be different for each point of a picture to be



displayed.

After switching on a television set, to which the blocks shown in Figure 1 are assigned, firstly the correction values K_s , K_d of the memories 11, 12 are read
5 into the second memories 14, 15 and are linked with one another via the first superimposition stage 16. The values linked in this way are fed as actuating signal S to the correction memory 24. In an operating mode, the
10 switch 22 is switched in such a way that the values S contained in the memory 24 are fed to the correction coil 28 via the digital/analog converter 25 and the amplifier 26.

At times during which a picture which is to be shown is not visible, such as, for example, during the
15 vertical blanking interval, under control of the electronic controller 23, the switch 22 is controlled in such a way that the output of the second offset memory 21 is connected to the input of the digital/analog converter 25. At these times, only the correction values from the
20 second offset memory 21 thus become effective.

By means of the electronic controller 23, the flip-flop 19 is likewise controlled, with the result that present values I , which can be measured via the resistor 29, are evaluated by the threshold value stage 30, and
25 the corresponding output signal is stored in the flip-flop 19.

Following the end of the control mode and at the beginning of the next operating mode, the switch 22 is
30 switched back into the position shown in Figure 1, and the flip-flop 19 is controlled in such a way that no further output signals from the threshold value stage 30 are stored.

The output signal I' of the flip-flop 19, which can assume either the state "zero" or the state "one", is
35 evaluated by the comparison stage 18. If, in this exemplary embodiment, the state of this output signal is equal to zero, a counter which is integrated in the stage 18 is incremented by one, otherwise it is decremented. The corresponding output signal (control actuating signal) R_s



is transmitted both to the first offset memory 17 and to the second offset memory 21. This result then has an influence both in the operating mode and in the control mode.

5 Figure 2 shows a second exemplary embodiment, in which the voltage deviation at the output of the amplifier 26b can assume positive and negative values. Means and signal waveforms which execute the same function as in the exemplary embodiment of Figure 1 are
10 designated in the same way as there and will be gone into only insofar as is necessary for the understanding of the invention.

 The significant difference from the exemplary embodiment of Figure 1 lies in the fact that an
15 additional mean value memory (MM) 31 is provided, in which the following value is stored:

$$1/2 * (\text{Max (MK)} - \text{Max (MO)});$$

here,

20 Max (MK) denotes the maximum correction value which, from experience, can be stored in the memory 24; and

 Max (MO) denotes the maximum correction value which, from experience, can be stored in the offset memory 21.

25 The determination of a value in accordance with the abovementioned formula has the advantage that, firstly, only positive offset values (0...Max(MO)) are contained in the memory 21. The neutral value is then located at $1/2 * \text{Max (MO)}$. This is particularly
30 advantageous in the case of the use of counters for offset value determination.

 As a further possibility, it is also possible to store in the memory 31 a value which corresponds to

$$1/2 * \text{Max (MK)}$$

35 In this case, the value range of the offset value stored in memory 21 covers both positive and negative values (-Max' (MO)...+Max' (MO)). The neutral point is then located at zero.

 In the case of the value of the memory 31, it is



important only that the correction values stored in memory 21 are displaced into the vicinity of the neutral point, at which no offset correction is necessary. As a result, the value range to be provided in memory 21 can be reduced.

The output from the memory 31 is connected to the first switching input of the switch 22 via a second superimposition stage 31a.

This has the effect that offset values, whose value range is lower than in the case of the preceding exemplary embodiment, are read to the memories 17, 21. Hence the memory requirement is reduced at the same resolution for the offset memories 17, 21.

A further example is shown in Figure 3. Here, too, means and signals which have already been described will only be gone into insofar as appears necessary.

As a significant difference from the exemplary embodiment of Figure 2, it is provided here that the output of the second dynamic memory 15 is connected directly to the input of the correction memory 24. The output of a superimposition stage 16' is connected to a third static memory (MS 3) 32, whose output leads to a third superimposition stage 33. The latter is connected by a further input to the output of the correction memory 24 and emits its output signal to the second switching input of the switch 22.

The functioning of the exemplary embodiment according to Figure 3 has the effect that the offset correction values and the static correction values are linked with each other within the microprocessor 13 and fed to the special stage 20. The dynamic correction values of the memory 15 are fed to the correction memory 24. Hence, if a drift appears, a distinctly reduced flow of data can be achieved as a whole.

Shown in Figure 4 is a further exemplary embodiment in which the deflection coil 28 is driven by two different drive chains which are formed by the already mentioned digital/analog converter 25 (drive chain A) and a further digital/analog converter 34 (drive



chain B).

The latter are alternately selected by a chain changeover switch 35 which is likewise driven by the electronic controller 23. By means of the same signal, two further changeover switches 36, 37 are likewise controlled, as a result of which the storage or reading out of the offset values belonging to the individual chains is effected.

If, in the control mode, the chain A is intended to be adjusted, the switches 35, 36, 37 assume that position which is shown in Figure 4. The offset values which are obtained as a result are read into the second offset memory 21 and into an A-offset memory (MO A) 39a.

If the chain B of the digital/analog converter 34 is to be adjusted, the switches 35, 36, 37 assume a position opposite to that shown in Figure 4 and the corresponding offset values are stored in the second offset memory 21 and the B-offset memory (MO B) 39b. Stored in an AB memory (M AB) 40, which is arranged between the linking point 16 and the linking point 16', is the mean value of the offset values of the chain A and of the chain B, that is to say

$$1/2 (\text{Offset (A)} + \text{Offset (B)}).$$

Offset (A) and Offset (B) are determined as a function of the value stored in memory 31, as already described above.

This mean value is passed additively to the linking point 16' and subtractively to the linking point 16.

Hence, only the dynamic manipulated variable and the difference values of the individual offset values A, B from the mean value are transmitted via the data line which is connected to the linking point 16.

From the linking point 16', on the other hand, the static actuating signal and the said mean value are transmitted, and are transmitted into a third static memory (MS 3) 41, which is a part of the special module 20. The values read out from the latter and the values read out from the correction memory 24 are superimposed



on one another in a further linking stage 42 and are fed to one of the control chains A, B with an appropriate position of the switch 22.

Figure 5 shows an exemplary embodiment in which the correction of controlled variables is used in a receiver.

A block designated as tuner 100 contains, in addition to the stages known per se, of a receiver, for example for radio-frequency or optical signals which are transmitted in a wireless or wire-bound manner, also stages for conditioning corresponding information in such a way that they can be made available to a user or means which are connected downstream. A control input 100a of the tuner is connected both to the output of an amplifier 101 and to a first input of a comparator 102. A first reference signal Ur1 is fed to the comparator 102 via a second input, and its output is connected to a controller (electronic control unit, ECU) 103. The controller 103 emits signals to an operating correction value memory (MB) 104, a channel switch 105 and to a test mode switch 106. Channel switching signals Sk and test mode switching signals St are formed by the ECU 103 as a function of entry signals which a user or means which are not shown can prescribe via an entry stage 107.

Inputs of the channel switch 105 are connected to station memories 108 in which, in each case in digital form, values for a frequency to be received are stored. The output of the channel switch 105 is connected to a switching input of the test mode switch 106, whose second switching input is fed a second reference signal Ur2. The output from the switch 106 leads to an addition stage 109 which is additionally fed first correction values Kw1 from a read-only correction value memory 110 and second correction values Kw2 from the memory 104.

The output of the addition stage 109 is connected to a digital/analog (D/A) converter 111, whose output signal is fed to the input of the amplifier 101.

The functioning of the exemplary embodiment of Figure 5 will be explained in the following text. During



a balancing within the context of a production process, deviations for the components and subassemblies used, such as for example from [sic] the D/A converter 111 and the amplifier 101, from prescribed operating variables, such as gain and the like, are determined and corresponding correction variables are determined, which are stored in the memory 110. The determination of the deviations from prescribed operating variables can be undertaken, for example, by means of measurements of the corresponding subassemblies, irrespective of the wiring of the tuner 100. Another possibility is to apply predetermined adjusting signals at the output of the switch 106 and to observe the behaviour of the tuner. By means of storing correction values in the memory 110, a desired reaction of the tuner 100 can be carried out as a function of these adjusting signals. This process is preferably implemented by means of a control method.

Since, in addition to the essentially constant deviations of the components, there occur such deviations as can change in the course of operation, for example as a result of ageing or thermal processes, the control signal St is additionally corrected at predetermined intervals by means of the comparator 102 and of the ECU 103. This is carried out in that, instead of the output signals from the station memory 108, the second reference signal $Ur2$ is fed to the addition stage 109 and the corresponding value of the control signal St is compared with the first reference signal $Ur1$.

These intervals are selected by means of the ECU 103 in such a way that any influence by the user or means which are connected downstream, to which the output signal of the tuner 100 is fed, is virtually negligible. It has proved to be especially suitable to carry out the changeover from the station memories 108 to the second reference signal $Ur2$ when a changeover from one channel, that is to say from one of the station memories 108, to another is intended to be carried out. This means that, if it is arranged via the input stage to change over to another channel, a switch is made firstly to the signal



Ur2 and the correction values stored in memory 104 are corrected if necessary. The changeover to the desired station memory is carried out only subsequently.

5 It is also conceivable that firstly the switch 105 and only then the switch 106 is driven. Simultaneous driving of these two switches 105, 106 is also conceivable, in order to accelerate the changeover procedure when a correction of the correction values is to be carried out.

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Patent Claims

1. Control method, in which a present value (I) is obtained, which is a measure of the effect of an actuating means (28), and a control actuating signal (Rs) is determined on the basis of a comparison of the present value (I) with a predetermined desired value, characterized in that
 - the control actuating signal (Rs) is determined in a control mode,
 - 10 - the control actuating signal (Rs) has superimposed on it previously determined correction signals (Ks, Kd), as a result of which an actuating signal (S) is generated, and in that
 - the actuating signal (S) or a signal (S'') derived therefrom is used in an operating mode for driving the actuating means.
2. Method according to Claim 1, characterized in that the control actuating signal (Rs) or a signal (Rs'') derived therefrom has superimposed on it further signals (M), with the result that the value range of the control actuating signal (Rs) is reduced.
3. Method according to one of Claims 1 or 2, characterized in that, from the previously determined correction signals, a first group (Ks) effects static corrections and a second group (Kd) effects dynamic corrections, in that in the operating mode the control actuating signal (Rs) is first superimposed on the correction signals (Ks) determined for the static corrections, as a result of which a static offset signal (Kso) is achieved, and in that the static offset signal (Kso) is subsequently superimposed on the correction signals (Kd) determined for the dynamic corrections, as a result of which the actuating signal (S) is obtained.
4. Method according to one of Claims 1 to 3, characterized in that the actuating means has more than one drive chain assigned to it, and in that actuating signals are determined for each of these drive chains.
5. Method according to Claim 4, characterized in that





the following signals are formed:

- a mean value signal (MAB) from the control actuating signals for the drive chains,
- difference signals from the control actuating signals and the mean value signal (MAB),

in that the mean value signal (MAB) is superimposed on the static manipulated variable and in that the difference signals are superimposed on the dynamic actuating signal.

6. Device for control, having

- actuating means (28),
- first means (29, 30), which register the effect of the actuating means and thereupon determine a present value,
- second means (18), which compare the present value with a desired value and thereupon generate a control actuating signal (Rs),

characterized in that

- control means (22, 23) are provided which have the effect that the control actuating signal (Rs) is determined in a control mode,
- a first memory (11) and a second memory (12) are provided, in which previously determined correction signals (Ks, Kd) are stored, which are superimposed on the control actuating signal (Rs) and as a result of this an actuating signal (S) is generated,
- the control means (22, 23) have the effect that the actuating signal (S) or a signal (S'') derived therefrom is used in an operating mode for driving the actuating means (28).

7. Device according to Claim 6, characterized in that a third memory (31) is provided in which further signals are stored which are superimposed on the control actuating signal (Rs) or a signal (Rs'') derived therefrom.

8. Device according to one of Claims 6 or 7, characterized in that more than one drive chain (A, B) is assigned to the actuating means (28), and in that the control means (23) have the effect that actuating signals are determined for each of these drive chains (A, B).





9. Device according to Claim 8, characterized in that
- a mean value stage (40) is provided, which forms a mean value (MAB) from the control actuating signals of the drive chains and difference signals from the control actuating signals and the mean value signal (MAB),
- 5 - a first superimposition stage (16) is provided, which superimposes the mean value signal (MAB) on the static manipulated variable,
- 10 - a second superimposition stage (16') is provided, which superimposes the difference signals on the dynamic actuating signal.
10. Use of the method according to Claims 1 to 5 or of the device according to Claims 6 to 9 for convergence
- 15 correction.

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