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Anmeldenummer / Filing No / N^o de la demande : 84 100 597.8

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Bezeichnung der Erfindung: System and process for identifying and updating
Title of invention: tuning constants
Titre de l'invention :

Klassifikation / Classification / Classement : G05B 13/02

ENTSCHEIDUNG / DECISION
vom / of / du 8 November 1989

Anmelder / Applicant / Demandeur : Measurex Corporation

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPU / EPC / CBE Article 84

Schlagwort / Keyword / Mot clé : "Claims clear - yes"
"Remittal to Examining Division"

Leitsatz / Headnote / Sommaire

Europäisches
Patentamt

Beschwerdekammern

European Patent
Office

Boards of Appeal

Office européen
des brevets

Chambres de recours



Case Number : T 50/89 - 3.5.1

D E C I S I O N
of the Technical Board of Appeal 3.5.1
of 8 November 1989

Appellant : Measurex Corporation
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Cupertino
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Representative : Ebbinghaus, Dieter et al
v. FÜNER, EBBINGHAUS, FINCK
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Decision under appeal : Decision of Examining Division 062
of the European Patent Office
dated 15 July 1988 refusing European
patent application No. 84 100 597.8
pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : E. Persson
Members : W.J.L. Wheeler
W. Riewald

Summary of Facts and Submissions

- I. Appellant's European patent application No. 84 100 597.8 was refused by a decision of the Examining Division 062 of the European Patent Office dated 15 July 1988. That decision was based on Claims 1 to 4 filed with a letter dated 5 August 1987.
- II. The reason given for the refusal was that Claims 1 and 4 were not clear. It was expressly stated at the end of the decision that a final decision about inventive step could not be taken.
- III. On 23 September 1988 the Appellant filed a notice of appeal against that decision. The fee for appeal was paid on the same day. The statement of grounds was filed on 24 November 1988, accompanied by a new set of Claims 1 to 4 (main request) and two further sets of Claims 1 to 4 (first and second auxiliary requests respectively).
- IV. The Appellant's main request is that the decision under appeal be set aside and a patent granted on the basis of Claims 1 to 4 (main request), filed on 24 November 1988. The Appellant recognises that the description may have to be amended.
- V. Claims 1 and 4 are now worded as follows:

"1. A process for determining tuning constants of a process control loop, the loop including at least a process control module (10) coupled to transmit control input signals to an actuator (14) to establish a target value of the actuator, the actuator being coupled to a controlled process (20), the process comprising

- (a) making a series of changes to the target value of the actuator;
- (b) measuring changes in the output of the controlled process resulting from the changes in the target value;
- (c) applying a first transformation to equations which describe characteristics of the actuator and the controlled process in order to perform an automatic tuning in the sense of an optimum control;

the process being characterized in that

the first transformation is carried out by obtaining a set of piecewise linear equations to describe non-linear characteristics of the actuator, wherein the outputs of the controlled process are linear functions of the control input signals to the actuator in mutually disjoint regions; and

in that the process further comprises

- (d) applying linear identification to the piecewise linear equations by utilizing the measured changes in the controlled process and the series of changes to the actuator target value to determine the parameters of the piecewise linear equations; and
- (e) applying a second transformation inverse to the first transformation, to the parameters to obtain the tuning constants which are then applied to the control module (10).

4. A system for determining tuning constants of a process control loop, the loop including at least a process control module (10) coupled to transmit control input signals to an actuator (14) to establish a target value of the actuator, the actuator being coupled to a controlled process (20), the system comprising:

- (a) means (44) coupled to the process control loop for making a series of changes to the target value of the actuator (14);
- (b) sensor means (28) coupled to the controlled process (20) for measuring the changes in the output of the controlled process resulting from the changes in the target value;
- (c) means (44) for applying a first transformation to equations represented and memorized therein, which describe characteristics of the actuator (14) and the controlled process (20), in order to perform an automatic tuning in the sense of an optimum control;

the system being characterized in that

a set of piecewise linear equations is obtained by the means (44) for carrying out the first transformation to describe non-linear characteristics of the actuator (14), wherein the outputs of the controlled process (20) are linear functions of the input signals to the actuator in mutually disjoint regions;

and in that the system further comprises

- (d) means (44) for applying linear identification to the piecewise linear equations to determine the parameters of the piecewise linear equations; and

(e) means (44) for applying a second transformation inverse to the first transformation, to the parameters to obtain the tuning constants which are then applied to the control module (10)."

Reasons for the Decision

1. The appeal is admissible.

2. The current version of the application does not contravene Article 123(2) EPC: all the features specified in the current claims are in the originally filed claims and/or disclosed in the originally filed description from page 4, line 6 to page 11, line 9, with reference to Figure 1 of the drawings; no amendment has yet been made to the description or drawings.

3. The sole ground for refusal of the application was that Claims 1 and 4 were not clear in the following respects:
 - 3.1 According to paragraph 2.2 of the decision under appeal, the expression "target value" as used in the claims was misleading and unclear. However, the Board notes that it is reasonably clearly explained in the description at page 4, lines 6 to 9, and page 5, lines 6 to 12, that during the normal operation of the control loop the actuator (14) receives control signals from the process control module (10) to establish the target value of the actuator, whereas during tuning parameter identification the actuator receives signals from the tuning constant identification module (44) in addition to or in place of the signals coming from the module (10), so that the target value is then established by either the module (44) alone or the modules (10) and (44) jointly. The expression "target value" appears to be well known in the art and, in the opinion of the Board, its use

in the claims is consistent with the expression's usual (self explanatory) meaning and there is nothing in the claims or description to suggest that any other meaning could be intended.

3.2 According to paragraph 2.3 of the decision under appeal, it could not be recognised in which manner the equations were represented and memorised. However, in the opinion of the Board, it does not matter how the equations are represented and memorised: any of the known ways of representing and memorising equations may be used. The important thing about the equations is not the way in which they are represented, but what it is that they describe. And the latter is clearly specified in the prior art and characterising portions of item c) of Claims 1 and 4. Namely, in common with the prior art, the equations describe characteristics of the actuator and the controlled process, and, in distinction from the prior art, the set of piecewise linear equations describe non-linear characteristics of the actuator, wherein the outputs of the controlled process are linear functions of the control input signals to the actuator in mutually disjoint regions.

3.3 Also according to paragraph 2.3 of the decision under appeal, it could not be recognised in which part of the loop the equations were represented and memorised. However, in the opinion of the Board, it does not matter where the equations are represented and memorised: the important functional requirement, that the obtained tuning constants are applied to the control module in order to perform an automatic tuning in the sense of an optimum control, is specified under items e) and c) of Claims 1 and 4.

3.4 Furthermore, according to paragraph 2.3 of the decision under appeal, it could not be recognised in which manner the (first) transformation was performed. Again, in the opinion

of the Board, it does not matter how this transformation is performed. A theoretical example of the first transformation is explained in the description from page 6, line 10 to page 9, line 2. It appears to the Board that, guided by the given example, a non-inventive person skilled in the art would be able to devise other first transformations for other equations describing characteristics of other actuators, and that he would be able to devise suitable ways to carry them out (e.g. by means of a suitably programmed computer), so that limitation of the claims to the particular example described or to a particular manner of performing the first transformation would not appear to be necessary to meet the requirements of Article 84 EPC. The claims are considered to be clear enough in this respect.

3.5 According to paragraph 2.4 of the decision under appeal, the phrase "applying the inverse transformation of the first transformation" was not clear. A theoretical example of the inverse transformation is explained in the description on page 9, lines 12 to 30. It appears to the Board that, guided by the given example, a non-inventive person skilled in the art would be able to form inverse transformations to other first transformations for other equations describing characteristics of other actuators, and that he would be able to devise suitable ways to carry them out (e.g. by means of a suitably programmed computer), so that limitation of the claims to the particular example described or to a particular manner of performing the inverse transformation would not appear to be necessary to meet the requirements of Article 84 EPC. The claims are considered to be clear enough in this respect.

3.6 According to paragraph 2.5 of the decision under appeal, the phrase "linear identification" was not clear. An example of a well known method of linear identification, namely the method of least squares, is mentioned in the description on

page 9, lines 3 to 11. It appears to the Board that a non-inventive person skilled in the art would be able to devise suitable ways to carry out this or an alternative method (e.g. by means of a suitably programmed computer), so that limitation of the claims to the particular example described or to a particular manner of performing linear identification would not appear to be necessary to meet the requirements of Article 84 EPC. The claims are considered to be clear enough in this respect.

4. In the result, the Board considers that the particular objections to lack of clarity set out in paragraphs 2.2 to 2.5 of the decision under appeal cannot be upheld, the claims according to the Appellant's main request are clear enough to enable the substantive examination in respect of inventive step and the other requirements of the EPC to be made, and that, in order to avoid loss of an instance, it is appropriate to remit the case to the Examining Division for further prosecution.

4.1 For avoidance of doubt, the Board points out that, if the Examining Division should come to the conclusion that the claimed subject-matter does not involve an inventive step, or that some other requirement of the EPC is not met, the present decision of the Board does not debar the Examining Division from requiring appropriate amendment of the claims and/or description and drawings.

5. The Appellant's auxiliary requests need not be considered.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division for further prosecution on the basis of the Appellant's main request (paragraph IV above), taking account of the remark in paragraph 4.1 above.

The Registrar:

S. Fabiani

S. Fabiani

The Chairman:

E. Persson

E. Persson