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**Datasheet for the decision
of 11 November 2021**

Case Number: T 3208/19 - 3.5.03

Application Number: 17157354.6

Publication Number: 3291032

IPC: G05B13/04, G05B19/404

Language of the proceedings: EN

Title of invention:

Model predictive control device, control method of model predictive control device, information processing program and recording medium

Applicant:

Omron Corporation

Headword:

Predictive disturbance compensation/OMRON

Relevant legal provisions:

EPC Art. 56

RPBA 2020 Art. 13(2)

Keyword:

Inventive step - main request and 2nd auxiliary request (no):
no credible technical effect

Admittance of requests filed after summons - 1st auxiliary
request (no): no exceptional circumstances and cogent reasons

Decisions cited:

G 0001/19, T 0336/14, T 2271/18



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Case Number: T 3208/19 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 11 November 2021

Appellant:
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Decision under appeal:

**Decision of the Examining Division of the
European Patent Office posted on 24 June 2019
refusing European patent application
No. 17157354.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair K. Bengi-Akyürek
Members: K. Peirs
C. Almberg

Summary of Facts and Submissions

- I. The appeal is against the decision of the examining division refusing the present European patent application for lack of inventive step (Article 56 EPC).
- II. In a communication issued pursuant to Article 15(1) RPBA 2020, the board indicated its preliminary opinion concerning inventive step of claim 1 of all claim requests then on file having regard to the following prior-art document:
- D3:** US 2016/0041536 A1.
- III. Oral proceedings before the board were held on 11 November 2021 by videoconference.
- IV. The appellant requests that the decision under appeal be set aside and that a patent be granted according to the claims of
- a **main request**, subject to the appealed decision and re-filed with the statement of grounds of appeal, or
 - **auxiliary request I**, filed with the reply to the communication under Article 15(1) RPBA 2020, or
 - **auxiliary request II**, subject to the appealed decision and re-filed with the statement of grounds of appeal (then labelled "auxiliary request I").
- At the end of the oral proceedings, the board's decision was announced.
- V. Claim 1 of the **main request** reads as follows (board's feature labelling):

"A model predictive control device (10, 100), using a model of a motion controlled object (30) to predict a controlled quantity (PV) of the controlled object (30) corresponding to a command value, and comprising

 a memory part (105); and

 an error computing part (104), computing a model predictive error (151), wherein the model predictive error (151) is an error between an actually measured value of the controlled quantity (PV) in a certain action cycle when an interference with the same size and applying timing is applied among continuous multiple action cycles and a controlled quantity predictive value using the model in the certain action cycle, wherein the model predictive error (151) of the certain action cycle is stored in the memory part (105); the model predictive control device (10, 100) being characterized by further comprising:

 an accepting part (107), accepting user operation, wherein the user operation is to select a designated action cycle after the certain action cycle, and

 a predictive value correcting part (106), correcting the predictive value in the designated action cycle by using the model predictive error (151) of the certain action cycle stored in the memory part (105), the model predictive control device (10, 100) further comprising:

 a display control part (108), displaying a time change of the model predictive error (151) stored into the memory part (105) to a user."

VI. Claim 1 of **auxiliary request I** reads as follows (amendments vis-à-vis claim 1 of the main request highlighted by the board):

"A model predictive control device (10, 100), using a model of a motion controlled object (30) to predict a

controlled quantity (PV) of the controlled object (30) corresponding to a command value, and comprising

a memory part (105); and

an error computing part (104), computing a model predictive error (151), wherein the model predictive error (151) is an error between an actually measured value of the controlled quantity (PV) in a certain action cycle when an interference with the same size and applying timing is applied among continuous multiple action cycles and a controlled quantity predictive value using the model in the certain action cycle, wherein the model predictive error (151) of the certain action cycle is stored in the memory part (105); the model predictive control device (10, 100) ~~being characterized by~~ further comprising:

an accepting part (107), accepting user operation, wherein the user operation is to select a designated action cycle after the certain action cycle, and

a predictive value correcting part (106), correcting the predictive value in the designated action cycle by using the model predictive error (151) of the certain action cycle stored in the memory part (105), the model predictive control device (10, 100) further comprising:

a display control part (108), displaying a time change of the model predictive error (151) stored into the memory part (105) to a user,

wherein the model predictive control device (10, 100) is characterized in that

when the size and the applied timing of the interference are not changed throughout the multiple action cycles, the predictive value correcting part (106) corrects the predictive value in the n-th action cycle after a given action cycle by using the model predictive error (151) in the action cycle of the predetermined time computed by the error computing

part (104); and
under the condition that the interference is
gradually changed,
the predictive value correcting part (106) corrects the
predictive value in the action cycle next to a certain
action cycle by using the model predictive error (151)
in the certain action cycle computed by the error
computing part (104)."

VII. Claim 1 of **auxiliary request II** reads as follows
(amendments vis-à-vis claim 1 of the main request
highlighted by the board):

"A model predictive control device (10, 100), using a
model of a motion controlled object (30) to predict a
controlled quantity (PV) of the controlled object (30)
corresponding to a command value, and comprising:

~~a memory part (105); and~~

an error computing part (104), computing a model
predictive error (151), wherein the model predictive
error (151) is an error between an actually measured
value of the controlled quantity (PV) in a certain
action cycle when an interference with the same size
and applying timing is applied among continuous
multiple action cycles and a controlled quantity
predictive value using the model in the certain action
cycle, ~~wherein the model predictive error (151) of the
certain action cycle is stored in the memory part
(105); the model predictive control device (10, 100)
being characterized by further comprising:~~

~~— an accepting part (107), accepting user operation,
wherein the user operation is to select a designated
action cycle after the certain action cycle,;~~ and

a predictive value correcting part (106),
correcting the predictive value in the designated
action cycle after the certain action cycles by using

the error computed in the certain action cycle by the error computing part (104) by using the model predictive error (151) of the certain action cycle stored in the memory part (105), the model predictive control device (10, 100) further comprising being characterized in that

a display control part (108), displaying a time change of the model predictive error (151) stored into the memory part (105) to a user

the predictive value correcting part (106) corrects the predictive value in the n-th action cycle after a given action cycle by using the model predictive error (151) in the action cycle of the predetermined time computed by the error computing part (104)."

Reasons for the Decision

1. *Technical background*

The present application concerns model predictive control of a movement of a device, where disturbances of this control are compensated based on an iterative approach. In each of the iterations, an error is calculated between a prediction by the model and a measurement of the device's movement when a particular disturbance is active. In accordance with the present invention, the error of iteration "n" is used to correct the prediction of iteration "n+1", which is intended to simplify the compensation of the disturbance.

2. *Main request: claim 1 - features*

Claim 1 of the **main request** comprises the following limiting features (board's feature labelling and

underlining, the latter being related to the features in strike-through of point 1.2.1 of the reasons of the decision under appeal):

- (a) A model predictive control device using a model of a motion controlled object to predict a controlled quantity of the controlled object corresponding to a command value;
- (b) comprising a memory part;
- (c) [comprising] an error computing part, computing a model predictive error, wherein the model predictive error is an error between an actually measured value of the controlled quantity in a certain action cycle when an interference with the same size and applying timing is applied among continuous multiple action cycles and a controlled quantity predictive value using the model in the certain action cycle, wherein the model predictive error of the certain action cycle is stored in the memory part;
- (d) comprising an accepting part, accepting user operation, wherein the user operation is to select a designated action cycle after the certain action cycle;
- (e) [comprising] a predictive value correcting part, correcting the predictive value in the designated action cycle by using the model predictive error of the certain action cycle stored in the memory part;
- (f) comprising a display control part, displaying a time change of the model predictive error stored into the memory part to a user.

3. *Main request: claim 1 - inventive step*

3.1 In its review of the decision under appeal, the board adopts, for the sake of argument, the appellant's

choice of **D3** as the most promising starting point for assessing inventive step and assumes, in accordance with the appellant's and the examining division's findings, that this document does not disclose the underlined portions of the subject-matter of claim 1 of point 2 above. These portions concern in essence the following distinguishing features:

- (1) a memory in which the error computed in accordance with feature (c) for a first action cycle is stored;
- (2) a user interface with which a user can select a second action cycle after the first action cycle;
- (3) a correction part which corrects, during the second action cycle by using the error of the first action cycle, the prediction of the controlled quantity of feature (a);
- (4) a display which shows the user how the error evolves over a particular time frame.

3.2 Following the appellant's logic, **distinguishing features (1) to (4)** would cooperatively accomplish the technical effect of "approximately master an interference form according to a waveform occurring in the time change", which would be achieved by a cognitive effort of the user based on the information on the display according to distinguishing feature (4) and the user input via the user interface of distinguishing feature (2).

3.3 It is the established jurisprudence of the Boards of Appeal that only those technical effects that are at least implied in the claims should be considered in the assessment of inventive step and that, if the invention does not solve a technical problem, it has no

distinguishing features which could contribute to inventive step (see e.g. G 1/19, Reasons 49 and 124).

3.4 In the present case, while a technical effect can indeed be achieved if a feature defining a presentation of information credibly assists the user in performing a technical task by means of a continued and/or guided human-machine interaction process (see e.g. T 336/14, headnote), the board holds that, for the following reasons, distinguishing features (1) to (4) do not credibly assist in such a process.

3.5 Regarding any "continued human-machine interaction", the selection by the user in accordance with distinguishing feature (2) can be a one-off action and need not be a *continued* interaction with the user interface. During the oral proceedings before the board, the appellant pointed out that such a "one-off action" is excluded because feature (c) would require "continuous multiple action cycles" to be observed. The board emphasises, however, that these action cycles merely indicate the time span over which the interference is applied, in contrast to the time span with which the user would interact with the accepting part of feature (d) or, correspondingly, with the user interface according to distinguishing feature (2).

3.6 With respect to any "guided human-machine interaction", claim 1 provides no *guidance* for the user whatsoever and fails to specify, for instance, the following aspects:

- (i) how to select the *second action cycle* of distinguishing feature (2), whichever entity the term "action cycle" may refer to in claim 1,

- (ii) how to guarantee and to verify that the error calculated in the *first action cycle* is in any way technically meaningful for the *second action cycle*, which is indeed a crucial assumption underlying distinguishing feature (3),
- (iii) how to choose the *time frame* of the evolution of the error shown on the display of distinguishing feature (4).

To illustrate the difficulties with which the skilled reader would have been faced when trying to discern any technical effect that is actually brought about by distinguishing features (1) to (4), it is expedient to consider aspects (i) to (iii) in more detail:

3.6.1 Regarding **aspect (i)**, the appellant argued during the oral proceedings that the skilled reader would have understood the term "action cycle". While the board does not contest this, claim 1 is at least ambiguous with respect to which entity this term would relate to. For instance, given that **feature (a)** concerns the control of a movable object, the skilled reader could interpret the expression "action" of the term "action cycle" to refer to the control of the movement of the object. This means that the term "action cycle" must be somehow connected to the model used to predict the object's "controlled quantity" and to perform the movement's control. Conversely, **feature (c)** indicates that the term is related to the time period during which the disturbance is applied. Moreover, from **feature (d)**, it appears that the action cycle can be selected by the user, which is not the case, at least not in general, if the action cycle relates, for instance, to the disturbance.

3.6.2 As regards **aspect (ii)**, it is not guaranteed that the use of an error of the first action cycle in a correction for the prediction of the second action cycle is always technically meaningful, in particular not within the context of an *unspecified* model for an *arbitrary* controlled quantity of a *general* motion-controlled object as required by **feature (a)**.

The description as filed does not provide any guidance in this respect either: it suggests merely that this use

- is either within the discretion of a user (see e.g. paragraph [0093] as filed)

or

- is implemented by "controller 10", i.e. the "model predictive device" of claim 1 itself (see e.g. paragraph [0131] as filed).

No practical details on the implementation of this correction, in particular when its application is technically meaningful, are however provided.

3.6.3 Regarding **aspect (iii)**, the particular "time frame" of **distinguishing feature (4)**, or, correspondingly, the "time change" of **feature (f)** is not restricted by any of the other features of claim 1. In particular, it need not be related to the *first* and the *second action cycle* in any way.

Moreover, the description as filed provides no details on how to select the "time change" of feature (f): paragraphs [0036] and [0189], for instance, only require "an interference [form] according to a

waveform" to occur in "the time change", which interference the user is supposed to "master" somehow. Assuming, to the appellant's benefit, that the skilled reader, guided by paragraph [0188] of the description as filed, were nevertheless able to derive some information on the *time change* from the "trend graph" depicted in Figure 10 as filed, to which paragraph [0189] of the description as filed relates, the board notes that it is not even apparent how the "interference" of that paragraph would be connected to any of the features of claim 1, in particular whether or not it is the same as the "interference" of **feature (c)**. The board emphasises in this respect that the "interference" of feature (c) need not be a *waveform* as mentioned in paragraph [0189] of the original description, but could pertain to any limitation that is not accounted for in the model of feature (a), e.g.

- a *malfunction* of the motion controlled object,
 - *material influences* of the motion controlled object's components,
 - *atmospheric influences* such as pressure, temperature, humidity
- or
- any *additional component* in the motion controlled object that was not considered in the model.

During the oral proceedings, the appellant argued that the clause "when an interference with the same size and applying timing is applied among continuous multiple action cycles" of feature (c) clearly defines the nature of the interference. Aside from the ambiguity

- of the term "action cycle[s]" (see point 3.6.1 above)

and

- of the expression "size" in the context of a *general* interference,

and the resulting difficulty to interpret this clause, the board further notes that the impact of an interference, and the point in time at which it takes place, does not restrict the interference to merely the form of a wave.

- 3.7 In points 1.1 and 1.2 of the reasons of the decision under appeal, the examining division analysed in essence the subject-matter of distinguishing features (1) to (4). However, it identified a technical effect only for **distinguishing feature (3)**, namely that of "*compensating the interference without a need to execute an operation processing of converting the change of the controlled quantity caused by the interference into the operating quantity, thereby simplifying the processing of compensating the change of the controlled quantity caused by the interference*" (see Reasons 1.2.3).

This technical effect is not credible either, given that distinguishing feature (3) is silent about any "compensating" or "simplifying" and, at most, only vaguely relates to an "interference" via the error mentioned in feature (c).

- 3.8 From points 3.6.1 to 3.6.3 above, it follows that the level of construction necessary for the skilled reader to assess which technical effect should actually be

ascribed to distinguishing features (1) to (4), if any, amounts to an undue burden. In the absence of any (credible) technical effect and thus an objective problem to be indeed solved, these distinguishing features cannot contribute to any inventive activity.

3.9 Hence, claim 1 of the main request does not involve an inventive step (Article 56 EPC).

4. *Auxiliary request I: admittance into the proceedings*

4.1 Claim 1 of **auxiliary request I** differs from claim 1 of the main request in that it further specifies that

- under the *condition* that the size and the applied timing of the interference are not changed throughout the multiple action cycles,
- (g) the predictive value correcting part corrects the predictive value in the n-th action cycle after a given action cycle by using the model predictive error in the action cycle of the predetermined time computed by the error computing part;

and that

- under the *condition* that the interference is gradually changed,
- (h) the predictive value correcting part corrects the predictive value in the action cycle next to a certain action cycle by using the model predictive error in the certain action cycle computed by the error computing part.

4.2 Auxiliary request I was filed *after* notification of the summons to oral proceedings before the board. Hence, the strict criteria of Article 13(2) RPBA 2020 do apply

regardless of when, thereafter, the amendment was made.

While the examining division may seem to have acted hastily by issuing a summons to oral proceedings as a *first* action in examination proceedings, this does not *per se* justify admittance of auxiliary request I at this late stage of the proceedings. Nor can the level of detail provided in the present board's communication issued under Article 15(1) RPBA 2020 be interpreted as an "invitation" to amend the appeal case (cf. T 2271/18, Reasons 3.3). In short, the board cannot recognise any "exceptional circumstances", which have been justified with "cogent reasons" by the appellant, that would warrant admittance of auxiliary request I into the proceedings.

- 4.3 For the sake of argument, the board points out that the specification of additional constraints on an entity that is not part of the claimed subject-matter, namely the "interference" mentioned in feature (c), cannot contribute in any way to any actual technical effect arising from distinguishing features (1) to (4).
- 4.4 As a consequence, auxiliary request I was not admitted into the proceedings (Article 13(2) RPBA 2020).
5. *Auxiliary request II: claim 1 - inventive step*
 - 5.1 Claim 1 of **auxiliary request II** differs from claim 1 of auxiliary request I in that **features (g) and (h)** are specified *without* their respective introductory conditions as mentioned in point 4.1 above.
 - 5.2 These features, as far as they can be understood, impose no further restrictions onto the subject-matter of distinguishing features (1) to (4). Hence, it is not

apparent how features (g) and (h) could change the conclusion for claim 1 of the main request as set out in point 3.9 above.

5.3 Therefore, claim 1 of auxiliary request II also does not involve an inventive step and auxiliary request II is likewise not allowable under Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chair:



B. Brückner

K. Bengi-Akyürek

Decision electronically authenticated