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Datasheet for the decision of 18 August 2020

Case Number: T 2703/16 - 3.5.03

Application Number: 11166788.7

Publication Number: 2388662

IPC: G05B11/01

Language of the proceedings: EN

Title of invention:
Systems, methods, and apparatus for controlling bi-directional servo actuator with PWM control

Applicant:
General Electric Company

Headword:
Bi-directional drive current/GE

Relevant legal provisions:
EPC Art. 123(2)
RPBA 2020 Art. 13(2)

Keyword:
Added subject-matter - auxiliary request 2 (yes)
Admittance of requests filed shortly before oral proceedings - main request and auxiliary requests 1, 3, 4 (no): no exceptional circumstances, fresh case and not clearly allowable

Decisions cited:
T 1459/11

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Case Number: T 2703/16 - 3.5.03

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 18 August 2020

Appellant: (Applicant)	General Electric Company 1 River Road Schenectady, NY 12345 (US)
Representative:	Freigutpartners IP Law Firm Hahnrainweg 4 5400 Baden (CH)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 14 July 2016 refusing European patent application No. 11166788.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	K. Schenkel
	J. Geschwind

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division refusing the present European patent application for added subject-matter (Article 123(2) EPC) and lack of clarity (Article 84 EPC).

II. Oral proceedings before the board were held on 18 August 2020.

The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims of the new **main request** filed with letter of 6 August 2020, or, in the alternative, of **auxiliary request 1** filed with letter of 6 August 2020, or **auxiliary request 2** (set of claims filed with the grounds of appeal), or **auxiliary requests 3 or 4** (filed as subordinate auxiliary requests 1 and 2 with letter of 17 August 2020).

At the end of the oral proceedings, the board's decision was announced.

III. Claim 1 of the **main request** and of **auxiliary request 1** reads as follows (labelling by the board):

(a) "A method for controlling bi-directional drive current through an actuator, the method comprising:

(b) receiving a direction control signal (502, 520; 608);

(c) manipulating a pair of switching devices (508, 526; 610, 612, 614, 616) to establish at least one switchable positive current path (534; 620) and at

least one switchable negative current path (536; 622) through the actuator (512, 618) based at least in part on receiving the direction control signal (502, 520, 608);

(d) coordinating the pair of switching devices (508, 526; 610, 612, 614, 616), wherein at least one of the switching devices (508, 526; 610, 612, 614, 616) is in an open state;

(e) providing feedback (504, 522; 403) based at least on the drive current (538, 540; 617, 619) through the actuator (512; 618); and

(f) controlling the drive current (538, 540; 617, 619) based at least on a comparison of the feedback (504, 522; 403) and a pulse width modulation signal (502, 520)."

IV. Claim 1 of **auxiliary request 2** reads as follows (labelling by the board):

(a) "A method for controlling bi-directional actuators (512; 618), the method comprising:

(b) receiving a direction control signal (502, 520; 608);

(c) manipulating switching devices (508, 526; 610, 612, 614, 616) to establish at least one switchable positive current path (534; 620) and at least one switchable negative current path (536; 622) through the actuator (512; 618) based at least in part on receiving the direction control signal (502, 520; 608);

(d) generating a switched excitation signal by a switching power amplifier (204) and applying the excitation signal to an excitation winding of a device attached or coupled to the actuator (512; 618); characterized in

(e) providing feedback (504, 522; 403) by a feedback circuit (234) which produces an excitation signal feedback (236) based al least on the drive current (538, 540; 617, 619) through the actuator (512; 618) or the coupled switched excitation signal; and

(f) controlling the drive current (538, 540; 617, 619) based at least on a comparison of the feedback (504, 522; 403) and a pulse width modulation signal (502, 520) as an actuator reference."

V. Claim 1 of **auxiliary request 3** reads as follows (labelling by the board)

"A system for controlling bi-directional actuators (512; 618), the system comprising:

(a) the actuator (512; 618);

(b) at least one power source (509, 527, 602);

(c) at least one positive current path (534; 620) and at least one negative current path (536; 622) through the actuator (512; 618), wherein the at least one positive current path and the at least one negative current path are each associated with one or more switching devices (508, 526; 610, 612, 614, 616); and

characterized in that a controller (102) is configured to:

(d) generate a switched excitation signal by a switching power amplifier (204) and apply the excitation signal to the excitation winding attached or coupled to the actuator;

(e) provide feedback by a feedback circuit (234) which produces an excitation signal feedback (236) based at least on the drive current through the actuator (512, 618) or the coupled switch excitation signal;

manipulate the two or more switching devices (508, 526; 610, 612, 614, 616) to establish the current paths (534, 536; 620, 622) based at least in part on a received direction control signal (502, 520; 608), and

(f) control the drive current (538, 540; 617, 619) based at least on a comparison of the feedback (504, 522; 403) based at least on the drive current through the actuator (512; 618) and a pulse width modulation signal (502, 520) as an actuator reference."

VI. Claim 1 of **auxiliary request 4** reads as follows (labelling and amendments with respect to claim 1 of auxiliary request 2 indicated by the board):

(a) "A method for controlling an actuator ~~bi-directional actuators~~ (512; 618), the method comprising:
generating a reference signal, comprising
generating a pulse width modulation (PWM) signal

generating, based on said reference signal, a switched drive signal for manipulating the actuator;

(b) receiving a direction control signal (502, 520; 608);

(c) manipulating switching devices (508, 526; 610, 612, 614, 616) to establish at least one switchable positive current path (534; 620) and at least one switchable negative current path (536; 622) through the actuator (512; 618) based at least in part on receiving the direction control signal (502, 520; 608);

(d) generating a switched excitation signal by a switching power amplifier (204) and applying the excitation signal to an excitation winding of a device attached or coupled to the actuator (512; 618); characterized in

(e) providing feedback (504, 522; 403) by a feedback circuit (234) which produces an excitation signal feedback (236) based at least on ~~the drive current (538, 540; 617, 619) through the actuator (512; 618) or~~ the coupled switched excitation signal; and

(f) controlling the reference signal based at least on the excitation signal feedback (236) ~~the drive current (538, 540; 617, 619) based at least on a comparison of the feedback (504, 522; 403) and a pulse width modulation signal (502, 520) as an actuator reference~~."

Reasons for the Decision

1. Background of the invention

The present invention relates to controlling a bi-directional drive current through an actuator based on a feedback associated with the actuator (claim 8 of the application as filed), in particular providing feedback based on the current associated with the actuator (claim 1 as filed).

Examples for an actuator given in the description as filed include mechanisms for controlling air and fuel flow but also position sensors which require an AC excitation current that is coupled from an excitation coil to one or more sensing coils dependent on the sensed position (see pages 1 and 5). In the case of such a sensor or actuator, the feedback is based on the output of the sensing coils (sensor 226 and feedback circuit 234; see FIG. 2 and page 9, last paragraph to page 10, first paragraph as filed).

2. Auxiliary request 2 - claim 1 - Article 123(2) EPC

2.1 Feature (e) of present claim 1 includes the case that the feedback, based on which the drive current through the actuator is controlled according to feature (f), is provided on the basis of the "coupled switched excitation signal". The "coupled switched excitation signal", however, is a signal of a device attached or coupled to the actuator, i.e. a device *different* from the actuator. This is because the switched excitation signal is applied to a device attached or coupled to the actuator (see feature (d) of claim 1) and generates within this device the coupled switched excitation

signal (see page 6, lines 6 to 11 of the description as originally filed).

2.2 However, the application as filed does not provide a basis for a method in which the feedback from a *first* actuator/sensor is used for controlling the current through *another* actuator.

2.3 The above wording of feature (e) was introduced with a claim set filed in the examination proceedings on 6 June 2016. In the accompanying letter and in a later letter dated 23 June 2016, the then applicant referred to page 6, lines 6 to 15 of the original description as a basis therefor. These lines read as follows (underlying added by the board):

"In certain embodiments, the position of the actuator, valve, or vane position may be determined by generating a switched excitation signal and applying the excitation signal to the excitation winding of an LVDT or similar device attached or coupled to the actuator. The excitation winding may couple the switched excitation signal to a secondary (or sensing) winding on the LVDT device with the coupling strength proportional to the position of the actuator, valve or vane position. The coupled switched excitation signal may be utilized as a second feedback for position control of the actuator via a servo. According to example embodiments of the invention, the reference signal may be controlled based at least in part on the second feedback associated with the switched excitation signal."

The board notes that these lines only disclose a position control of the actuator based on the feedback from the sensor rather than a direct control of the

current through the actuator. In this respect, the board holds that in the embodiment shown in Fig. 2, which includes an actuator 216 coupled to a position sensor 226 and where the actuator and the sensor are provided with a bi-directional current, the feedback of the sensor is supplied to controller 202 and not to driver 208 providing the current for actuator 216 (see also page 10, first paragraph as filed).

2.4 The board therefore concludes that claim 1 does not comply with Article 123(2) EPC and that, consequently, auxiliary request 2 is not allowable.

3. Main request and auxiliary request 1 - admittance (Article 13(2) RPBA 2020)

3.1 The main request and auxiliary request 1 were filed for the first time **less than two weeks** before the arranged oral proceedings in response to the board's communication under Article 15(1) RPBA 2020. Since they were filed after the notification of the summons to oral proceedings before the board, their admittance is in principle governed by Article 13(2) RPBA 2020.

3.2 According to Article 13(2) RPBA 2020, any amendment to a party's case after notification of a summons to oral proceedings shall in principle **not be taken into account** unless there are **exceptional circumstances**, which have been justified with **cogent reasons** by the party concerned. Hence, the question is whether exceptional circumstances are objectively apparent in the present case.

3.3 Claim 1 of these requests differs from claim 1 of the claim set underlying the appealed decision and of the claim set filed with the statement of grounds of appeal

in that all limitations related to the "switched excitation signal", the "coupled switched excitation signal" and the "device" which is attached or coupled to the actuator and to which the switched excitation signal is applied have been **removed**.

In consequence, the claimed method has significantly changed, namely from a method for controlling the drive current of an actuator based on a feedback based on signals of another device to a method for controlling the drive current of an actuator based on a feedback based on signals of the actuator itself.

3.4 The board notes that the claims as originally filed were directed to a control method involving only one device/actuator and that the change towards a control method involving an actuator and a further device was made during the examination proceedings and maintained until its conclusion. By deleting the limitation related to the "(coupled) switched excitation signal" and the "device coupled or attached to the actuator", the appellant essentially has reset the case and thereby let the appealed decision become irrelevant. Thus, a fresh case has been created.

If the board were to admit the main request and auxiliary request 1, it would be compelled to either give a first ruling on a significantly changed subject-matter, which would run contrary to the primary purpose of second-instance proceedings (i.e. reviewing the contested decision), or remit the case to the department of first instance, which would clearly be contrary to procedural economy.

3.5 The appellant argued that the board's communication was issued on 16 June 2020 and thus significantly less than four months in advance of the oral proceedings and left

not enough time to adequately prepare a response, in particular taking into account that the country where the appellant is seated is heavily affected by the COVID-19 pandemic.

The board however concludes that arguments based on the COVID-19 pandemic, which began in spring 2020, cannot justify that claims directed to a control method for an actuator without involvement of a further device were not filed earlier in the examination proceedings in 2016. In other words, no exceptional circumstances within the meaning of Article 13(2) RPBA 2020 can be recognised in the present case. The board recalls that the primary purpose of a board's preliminary opinion is to establish the framework of the appointed oral proceedings, i.e. to prepare the oral proceedings, rather than constituting an invitation to a party to make further submissions or to file further requests (see e.g. T 1459/11, Reasons, point 3.2).

3.6 Lastly, as to the *prima facie* allowability of claim 1 of the present claim requests, the board also notes that it is not clear whether or not the "pulse width modulation signal" corresponds to the "direction control signal" and - if not - how this "pulse width modulation signal" is actually derived according to the original teaching, so that the skilled person may indeed carry out the claimed invention (Articles 84 and 83 EPC).

3.7 In view of the above, the board, exercising its discretion under Article 13(2) RPBA 2020, decided not to admit the main request and auxiliary request 1 into the appeal proceedings.

4. Auxiliary requests 3 and 4 - admittance (Article 13(2) RPBA 2020)

4.1 Auxiliary requests 3 and 4 were filed **two hours** before the arranged oral proceedings. Hence, their admittance is even more subject to Article 13(2) RPBA 2020. Thus, the above considerations as to admittance apply *a fortiori* to these claim requests (see point 3.5 above).

4.2 More specifically, claim 1 of **auxiliary request 3** relates to a system which includes a controller configured to provide a feedback based at least on the drive current through the actuator or the coupled switched excitation signal and to control the drive current through the actuator based at least on a comparison of the feedback based at least on the drive current through the actuator. This means that its wording does not exclude the "coupled switched excitation signal" as a basis for the feedback, and a pulse width modulation signal (features (e) and (f)).

4.3 Hence, claim 1 includes the case that the feedback is provided based on a signal of a device *different* from the actuator, namely the device providing the "coupled switched excitation signal", and that it is used for controlling the current through the actuator as required by claim 1 of auxiliary request 2. The objections raised under Article 123(2) EPC in point 2 above therefore apply *mutatis mutandis* to claim 1 of auxiliary request 3.

4.4 Claim 1 of **auxiliary request 4** relates to a method which includes in feature (f) the step of controlling the reference signal based at least on the excitation signal feedback.

4.5 This request therefore includes for the first time during these appeal proceedings and the preceding examination proceedings the step of controlling the "reference signal" instead of controlling the "current through the actuator". Having to deal with a feature never discussed before is clearly detrimental to procedural economy and against the purpose of the appeal proceedings, namely to examine the correctness of the contested decision.

4.6 Furthermore, the amendment does not *prima facie* overcome the issue under Article 123(2) EPC raised by the board since an "excitation signal feedback" is only disclosed on page 9, lines 1 to 6 of the application as originally filed. This passage, however, does not provide a basis for controlling the reference signal based on the "excitation signal feedback".

4.7 Accordingly, auxiliary requests 3 and 4 were also not admitted into the appeal proceedings (Article 13(2) RPBA 2020).

5. Conclusion

As there is no admissible and allowable claim request, the appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated