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Datasheet for the decision of 19 January 2010

Case Number: T 0162/07 - 3.5.02

Application Number: 02721219.0

Publication Number: 1368897

IPC: H03M 1/12

Language of the proceedings: EN

Title of invention:
Apparatus and method for adjusting filter frequency in relation to sampling frequency

Applicant:
Optimum Power Technology, L.P.

Headword:
-

Relevant legal provisions:
EPC Art. 56, 123(2)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step - after amendment (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0162/07 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 19 January 2010

Appellant: Optimum Power Technology, L.P.
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Representative: Röthinger, Rainer
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 19 July 2006 refusing European patent application No. 02721219.0 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: M. Ruggiu
Members: J.-M. Cannard
H. Preglau

Summary of Facts and Submissions

I. The appellant contests the decision of the examining division to refuse European patent application No. 02 721 219.0. The reason for the refusal was that the subject-matter of claim 1 then on file did not involve an inventive step having regard to document D1: US-A-4 763 207 (Article 52(1) and 56 EPC).

II. With a communication dated 17 September 2009 annexed to summons to oral proceedings, reference was made, as regards inventive step, to the following documents of the state of the art:

D4: US-A-6 138 504, and

D5: US-A-4 620 313.

III. Following the filing by the appellant of a revised set of claims in preparation for the oral proceedings, with a communication dated 13 January 2010, the Board cited the following document:

D6: data sheet of the "Linear Technology LTC 1066-1 14-Bit DC Accurate Clock-Tunable 8th Order Elliptic or Linear Phase Lowpass Filter", which seems to correspond to the commercially available model LTC 1066-1, manufactured by Linear Technology of Milpitas California, quoted on page 13 of the originally filed application.

IV. Independent claims 1 and 6 of the current request filed in the course of the oral proceedings held on 19 January 2010 before the Board read as follows:

"1. A data acquisition system (100), comprising:

- a sensor providing an analog signal (102) representative of an operating condition of a rotating engine,

- a filter (101) filtering the analog signal (102) to provide a filtered signal (110),

- a data acquisition device (112) sampling the filtered signal (110) at a sampling frequency which varies with the speed of the engine so that the filtered signal is sampled each time a shaft of the engine rotates a predetermined number of degrees; characterized in that:

the data acquisition device is configured to provide a sampling frequency signal (114) to the filter (101),

and that the filter is a self-tuning filter (101) which is configured to maintain a cut-off frequency at a constant ratio of the sampling frequency, wherein the self-tuning filter maintains the delay between receipt of the analog signal at the filter and output of the filtered signal from the filter to the data acquisition device constant at a fixed number of sampling cycles."

"6. A method of acquiring data in a rotating engine, comprising the steps of:

- sensing an operating condition of the engine and providing an analog signal (102) representative of the sensed condition,
- filtering the analog signal (102) using a filter to provide a filtered signal (110),

- sampling the filtered signal (110) at a sampling frequency which varies with the speed of the engine so that the filtered signal is sampled each time a shaft of the engine rotates a predetermined number of degrees; characterized by:

- tuning a filter cut-off frequency to maintain the filter cut-off frequency at a constant ratio of the sampling frequency, wherein the filter is a self-tuning filter which maintains the delay between receipt of the analog signal at the filter and output of the filtered signal from the filter constant at a fixed number of sampling cycles."

Claims 2 to 5 and claim 7 of the set of claims filed during the oral proceedings are dependent on claim 1 and claim 6, respectively.

V. The appellant requested that the decision under appeal be set aside and that a patent be granted in the following version: claims no 1 to 7, received during the oral proceedings, description, pages 1, 2, 2a, 2b, 3 to 16, received during the oral proceedings, drawings: figures 1/7 to 7/7, filed with entry into the regional phase before the EPO, with letter of 26 August 2003.

VI. The appellant essentially argued as follows:

The application as originally filed disclosed a self-tuning filter in which the delay between the receipt of a signal at the filter and the output of the filtered signal was constant at a fixed number of sampling cycles.

Thus, the current request did not contravene Article 123(2) EPC.

Independent claims 1 and 6 differed from the closest prior art, document D4, by two independent features: a filter cut-off frequency which was maintained at a constant ratio of the sampling frequency, and a filter delay which was constant at a fixed number of sampling cycles, that is to say a filter having a linear phase response.

D4 disclosed a data acquisition system for a rotating engine in which input signals from sensors were first filtered in anti-aliasing filters having a fixed cut-off frequency. The signals were then sampled at a rate multiple of the firing frequency and filtered to provide a mean value of the input signals. There was no need to preserve the phases of the signals in order to obtain a mean value of the signals. D4 thus did not suggest the use of a low pass filter having a linear phase response.

Document D5 disclosed a data acquisition system for CT scanners in which input signals were filtered in a switched capacitor filter whose cut-off frequency was maintained at a constant ratio of the sampling frequency. However, D5 did not suggest the use of a self-tuning filter having a linear phase response.

Document D6 was a revised version of an earlier data sheet and could possibly not have been made available to the public before the priority date of the application in suit. The clock-tunable low pass filter disclosed in D6 had three different modes of operation. There was no obvious reason for using said clock-tunable filter in

the system of D4 and then selecting the mode providing a linear phase response.

Reasons for the Decision

1. The appeal is admissible.

Admissibility of the amendments

2. The Board is satisfied that the claims and the description according to the current request meet the requirements of Article 84 EPC and do not contravene Article 123(2) EPC.

2.1 This applies particularly to independent claims 1 and 6 whose pre-characterising features are disclosed in figure 1/7 and the related passages of the description as originally filed (see published application WO02/071617, Corrected version, page 7, lines 4 to 27; page 8, lines 11 to 14). The features of the characterising part of claims 1 and 6 are disclosed in figures 4/7 and 6/7 and the related passages of the description (published application, page 11, lines 15 to 18; page 13, line 26 to 28; page 15, lines 24 to 27).

2.2 The features of claims 2 to 5 and 7 are disclosed in figures 1/7 and 7/7, at page 7, lines 4 to 14 and page 14, lines 16 and 17 of the published application.

2.3 The description has been adapted to the amended claims, in particular unclear passages which were inconsistent with the subject-matter of the current claims have been deleted. A mention of the cited prior art documents, in

particular the relevant documents D4 and D5, has been included.

Current request - Novelty and inventive step

3. The novelty of the subject-matter of the independent claims 1 and 6 has not been disputed.

4. Document D4, which can be taken as the closest prior art, discloses the features of the pre-characterising part of claim 1.

4.1 D4 describes more specifically a data acquisition system (figures 1 and 4; column 3, lines 15 to 17; column 3, line 57 to column 4, line 7; column 4, line 64 to column 5, line 28), comprising:

- a sensor 117 providing an analog signal EGRP representative of an operating condition of a rotating engine 10,

- a filter 400 filtering the analog signal EPRG to provide a filtered signal,

- a data acquisition device 404 sampling the filtered signal at a sampling frequency RPM which varies with the speed of the engine so that the filtered signal is sampled each time a shaft of the engine rotates a predetermined number of degrees.

4.2 However, the anti-aliasing filter 400 has a fixed cut-off frequency f1. The features recited in the characterising part of claim 1 are not disclosed in D4.

5. Starting from D4 and having regard to the effect provided by the features specified in the characterising part of claim 1, the objective technical problem addressed by the invention can be seen as providing a low pass filter which is able to cancel in an optimal way aliasing frequencies which depend on a sampling frequency varying with the speed of the motor while making it possible to resolve a timing mismatch of the samples of the filtered signal, as mentioned in the application (published application, page 1, lines 15 and 16, 21 and 22). According to the characterising part of claim 1, the solution to this problem is to provide a filter whose cut-off frequency is maintained at a constant ratio of the sampling frequency and whose filter delay is maintained constant at a fixed number of sampling cycles, which means using a filter having a linear phase response.

6. No suggestion of such a solution can be found in any of the prior art documents, in particular in the closest prior art document D4 which discloses a data acquisition system differing from the subject-matter of claim 1 by two independent features. Nor can it be derived from a combination of them, and more specifically not from the combination of D4 with D5.

7. D5 (figures 1 and 2; column 1, line 54 to column 2, line 25; column 2, line 38 to column 4, line 17) discloses a data acquisition system for acquiring data in a rotating application (CT scanners) in which analog detector signals are filtered by a cut-off frequency filter 60 for cancelling aliasing frequencies before being sampled (A/D converter) at a variable frequency. In order to optimise the attenuation of the aliasing

frequencies, the filter 60 is a self-tuning low pass filter whose cut-off frequency is controlled as a function of the degree of rotation of an encoder 20 so as to maintain constant the ratio of the cut-off frequency to the sampling frequency, which is also determined as a function of a degree of rotation of the encoder.

7.1 The data acquisition system of D4 could be modified to include a self-tuning filter whose cut-off frequency is controlled to be at a constant ratio of the sampling frequency as taught in D5. However, neither D4 nor D5 suggests the use of a filter having a linear phase response, i.e. a filter which "maintains the delay between receipt of the analog signal at the filter and output of the filtered signal from the filter to the acquisition device constant at a fixed number of sampling cycles". Thus, simply combining D4 with D5 would not provide the invention specified in claim 1, which thus is not obvious with respect to the combination of D4 and D5.

7.2 The data sheet of D6 relates to a clock-tunable low pass filter. According to the appellant, D6 might be a revision dated September 2005, thus after the priority date of the application, of a data sheet of 1994 and does not form part of the state of the art because it is not certain that D6 has the same content as the data sheet of 1994. Moreover, the clock-tunable filter described in D6 has three different modes of operation, only one of said modes showing a linear phase response. As D4 does not suggest the use of a filter having a linear phase response, in any case the skilled person

simply combining D4 with D6 would not arrive at the invention specified in claim 1 in an obvious way.

7.3 Document D1 discloses a system and a method for processing audio signals in which a low pass filter has a cut-off frequency selected as a function of a sampling frequency. However, D1 does not suggest to use a self-tuning filter having a linear phase response.

8. The same considerations apply to independent claim 6 which relates to a method of acquiring data in a rotating engine which comprises all the steps performed in the data acquisition system according to claim 1.

9. For the foregoing reasons, in the Board's judgement, the subject-matter of independent claims 1 and 6 according to the current request is considered to involve an inventive step within the meaning of Article 56 EPC. The application as amended meets the requirements of the EPC.

Order

For these reasons it is decided that :

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent in the following version:

   claims no 1 to 7, received during the oral proceedings of 19 January 2010,

   description, pages 1, 2, 2a, 2b, 3 to 16, received during the oral proceedings of 19 January 2010,

   drawings: figures 1/7 to 7/7, filed with entry into the regional phase before the EPO, with letter of 26 August 2003.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu