Claims

1. An audio processor ~~(50)~~ for processing an audio signal ~~(55)~~ comprising:

an audio signal phase measure calculator ~~(60)~~ configured for calculating a phase measure ~~(80)~~ of an audio signal for a time frame ~~(75a)~~;

a target phase measure determiner ~~(65)~~ for determining a target phase measure ~~(85)~~ for said time frame ~~(75a)~~;

a phase corrector ~~(70)~~ configured for correcting phases ~~(45)~~ of the audio signal ~~(55)~~ for the time frame ~~(75a)~~ using the calculated phase measure ~~(80)~~ and the target phase measure ~~(85)~~ to obtain a processed audio signal ~~(90)~~.

2. The audio processor ~~(50)~~ according to claim 1,

wherein the audio signal ~~(55)~~ comprises a plurality of subband signals ~~(95a,b)~~ for the time frame ~~(75a)~~;

wherein the target phase measure determiner is configured for determining a first target phase measure ~~(85a)~~ for a first subband signal ~~(95a)~~ and a second target phase measure ~~(85b)~~ for a second subband signal ~~(95b)~~;

wherein the audio signal phase measure calculator ~~(60)~~ is configured for determining a first phase measure ~~(80a)~~ for the first subband signal ~~(95a)~~ and a second phase measure ~~(80b)~~ for the second subband signal ~~(95b)~~;

wherein the phase corrector ~~(70)~~ is configured for correcting a first phase ~~(45a)~~ of the first subband signal ~~(95a)~~ using the first phase measure ~~(80a)~~ of the audio signal ~~(55)~~ and the first target phase measure ~~(85)~~ to obtain a first processed subband signal ~~(90a)~~ and for correcting a second phase ~~(45b)~~ of the second subband signal ~~(95b)~~ using the second phase measure ~~(80b)~~ of the audio signal ~~(55)~~ and the second target phase measure ~~(85b)~~ to obtain a second processed subband signal ~~(90b)~~; and

an audio signal synthesizer ~~(100)~~ for synthesizing the processed audio signal ~~(90)~~ using the processed first subband signal ~~(90a)~~ and the processed second subband signal ~~(90b)~~.

3. The audio processor ~~(50)~~ according to one of claims 1 or 2,

wherein the phase measure ~~(80)~~ is a phase derivative over time;

wherein the audio signal phase measure calculator ~~(60)~~ is configured for calculating, for each subband ~~(95)~~ of a plurality of subbands, the phase derivative of a phase value of a current time frame ~~(75b)~~ and a phase value of a future time frame ~~(75c)~~;

wherein the phase corrector ~~(70)~~ is configured for calculating, for each subband ~~(95)~~ of the plurality of subbands of the current time frame ~~(75b)~~, a deviation ~~(105)~~ between the target phase derivative ~~(85)~~ and the phase derivative over time ~~(80)~~;

wherein a correction performed by the phase corrector ~~(70)~~ is performed using the deviation.

4. The audio processor ~~(50)~~ according to one of claims 1 - 3,

wherein the phase corrector ~~(70)~~ is configured for correcting subband signals ~~(95)~~ of different subbands of the audio signal ~~(55)~~ within the time frame ~~(75)~~, so that frequencies of corrected subband signals ~~(90a,b)~~ have frequency values being harmonically allocated to a fundamental frequency of the audio signal ~~(55)~~.

5. The audio processor ~~(50)~~ according to one of claims 1 - 4,

wherein the phase corrector ~~(70)~~ is configured for smoothing the deviation ~~(105)~~ for each subband ~~(95)~~ of the plurality of subbands over a previous ~~(75a)~~, the current ~~(75b)~~, and a future time frame ~~(75c)~~ and is configured for reducing rapid changes of the deviation ~~(105)~~ within a subband ~~(95)~~.

6. The audio processor ~~(50)~~ according to claim 5,

wherein the smoothing is a weighted mean;

wherein the phase corrector ~~(70)~~ is configured for calculating the weighted mean over the previous ~~(75a)~~, the current ~~(75b)~~ and the future time frame ~~(75c)~~, weighted by a magnitude ~~(47)~~ of the audio signal ~~(55)~~ in the previous ~~(75a)~~, the current ~~(75b)~~ and the future time frame ~~(75c)~~.

7. The audio processor ~~(50)~~ according to one of claims 1 - 6,

wherein the phase corrector ~~(70)~~ is configured for forming a vector of deviations ~~(105)~~, wherein a first element of the vector refers to a first deviation ~~(105a)~~ for the first subband ~~(95a)~~ of the plurality of subbands and a second element of the vector refers to a second deviation ~~(105b)~~ for the second subband ~~(95b)~~ of the plurality of subbands from a previous time frame ~~(75a)~~ to a current time frame ~~(75b)~~;

wherein the phase corrector ~~(70)~~ is configured to apply the vector of deviations ~~(105)~~ to the phases ~~(45)~~ of the audio signal, wherein the first element of the vector is applied to a phase ~~(45a)~~ of the audio signal ~~(55)~~ in a first subband ~~(95a)~~ of a plurality of subbands of the audio signal ~~(55)~~ and the second element of the vector is applied to a phase ~~(45b)~~ of the audio signal ~~(55)~~ in a second subband ~~(95b)~~ of the plurality of subbands of the audio signal ~~(55)~~.

8. The audio processor ~~(50)~~ according to one of claims 1 - 7,

wherein the target phase measure determiner ~~(65)~~ is configured for obtaining a fundamental frequency estimate ~~(85)~~ for a time frame ~~(75)~~;

wherein the target phase measure determiner ~~(65)~~ is configured for calculating a frequency estimate ~~(85)~~ for each subband ~~(95)~~ of the plurality of subbands of the time frame ~~(75)~~ using the fundamental frequency for the time frame ~~(75)~~.

9. The audio processor ~~(50)~~ according to claim 8,

wherein the target phase measure determiner ~~(65)~~ is configured for converting the frequency estimates ~~(85)~~ for each subband ~~(95)~~ of the plurality of subbands into a

phase derivative over time (85) using a total number of subbands (95) and a sampling frequency of the audio signal (55).

10. The audio processor (50) according to claim 8 or 9,

wherein the target phase measure determiner (65) is configured for forming a vector of frequency estimates (85) for each subband (95) of the plurality of subbands, wherein the first element of the vector refers to a frequency estimate (85a) for a first subband (95a) and a second element of the vector refers to a frequency estimate (85b) for a second subband (95b);

wherein the target phase measure determiner (65) is configured for calculating the frequency estimate (85) using multiples of the fundamental frequency, wherein the frequency estimate (85) of the current subband (95) is that multiple of the fundamental frequency which is closest to the center of the subband (95), or wherein the frequency estimate (85) of the current subband (95) is a border frequency of the current subband (95) if none of the multiples of the fundamental frequency are within the current subband (95).

11. A decoder (110) for decoding an audio signal (55), the decoder (110) comprising:

an audio processor (50) according to one of claims 1 - 10;

a core decoder (115) configured for core decoding an audio signal (25) in a time frame (75) with a reduced number of subbands with respect to the audio signal (55);

a patcher (120) configured for patching a set of subbands (95) of the core decoded audio signal (25) with the reduced number of subbands, wherein the set of subbands forms a first patch (30a), to further subbands in the time frame (75), adjacent to the reduced number of subbands, to obtain an audio signal (55) with a regular number of subbands;

wherein the audio processor (50) is configured for correcting the phases (45) within the subbands of the first patch (30a) according to a target function (85).

12. The decoder ~~(110)~~ according to claim 11,

wherein the patcher ~~(120)~~ is configured for patching the set of subbands ~~(95)~~ of the audio signal ~~(25)~~, wherein the set of subbands forms a second patch, to further subbands of the time frame ~~(75)~~, adjacent to the first patch; and

wherein the audio processor ~~(50)~~ is configured for correcting the phases ~~(45)~~ within the subbands ~~(95)~~ of the second patch; or

wherein the patcher ~~(120)~~ is configured for patching the corrected first patch to further subbands of the time frame, adjacent to the first patch.

13. The decoder ~~(110)~~ according to claim 11 or 12, the decoder comprising:

a data stream extractor ~~(130)~~ configured for extracting a fundamental frequency ~~(140)~~ of the current time frame ~~(75)~~ of the audio signal ~~(55)~~ from a data stream ~~(135)~~, wherein the data stream further comprises the encoded audio signal ~~(145)~~ with the reduced number of subbands; or

a fundamental frequency analyzer ~~(150)~~ configured for analyzing the core decoded audio signal ~~(25)~~ in order to calculate a fundamental frequency ~~(140)~~.

14. ~~E~~An encoder ~~(155)~~ for encoding an audio signal ~~(55)~~, the encoder ~~(155)~~ comprising:

a core encoder ~~(160)~~ configured for core encoding the audio signal ~~(55)~~ to obtain a core encoded audio signal ~~(145)~~ having a reduced number of subbands with respect to the audio signal ~~(55)~~;

a fundamental frequency analyzer ~~(175)~~ for analyzing the audio signal ~~(55)~~ or a low-pass filtered version of the audio signal for obtaining a fundamental frequency estimate ~~(140)~~ of the audio signal ~~(155)~~;

a parameter extractor ~~(165)~~ configured for extracting parameters of subbands of the audio signal ~~(55)~~ not included in the core encoded audio signal ~~(145)~~;

an output signal former ~~(170)~~ configured for forming an output signal ~~(135)~~ comprising the core encoded audio signal ~~(145)~~, the parameters ~~(190)~~, and the fundamental frequency estimate ~~(140)~~.

15. ~~E~~The encoder ~~(155)~~ according to claim 14, wherein the output signal former ~~(170)~~ is configured to form the output signal ~~(135)~~ into a sequence of frames, wherein each frame comprising the core encoded audio signal ~~(145)~~, the parameters ~~(190)~~, and wherein only each N^{th} frame comprising the fundamental frequency estimate ~~(140)~~, wherein N is greater or equal than 2.

16. A method ~~(2300)~~ for processing an audio signal ~~(55)~~, the method comprising the following steps:

calculating a phase measure of an audio signal ~~(55)~~ for a time frame with an audio signal phase measure calculator ~~(60)~~;

determining a target phase measure for said time frame with a target phase measure determiner ~~(65)~~;

correcting phases of the audio signal ~~(55)~~ for the time frame with a phase corrector ~~(70)~~ using the calculated phase measure and the target phase measure to obtain a processed audio signal ~~(90)~~.

17. ~~M~~A method ~~(2400)~~ for decoding an audio signal ~~(55)~~, the method comprising the following steps:

decoding an audio signal ~~(25)~~ in a time frame with a reduced number of subbands with respect to the audio signal ~~(55)~~;

patching a set of subbands of the decoded audio signal ~~(25)~~ with the reduced number of subbands, wherein the set of subbands forms a first patch, to further subbands in the time frame, adjacent to the reduced number of subbands, to obtain an audio signal ~~(55)~~ with a regular number of subbands;

correcting the phases within the subbands of the first patch according to a target function with the audio processor ~~(50)~~.

18. ~~M~~A method for encoding an audio signal ~~(55)~~, the method comprising the following steps:

core encoding the audio signal with a core encoder ~~(160)~~ to obtain a core encoded audio signal having a reduced number of subbands with respect to the audio signal ~~(55)~~;

analyzing the audio signal ~~(55)~~ or a low-pass filtered version of the audio signal with a fundamental frequency analyzer for obtaining a fundamental frequency estimate ~~(140)~~ of the audio signal;

extracting parameters of subbands of the audio signal ~~(55)~~ not included in the core encoded audio signal ~~(145)~~ with a parameter extractor ~~(165)~~;

forming an output signal ~~(135)~~ comprising the core encoded audio signal ~~(145)~~, the parameters ~~(190)~~, and the fundamental frequency estimate ~~(140)~~ with an output signal former ~~(170)~~.

19. ~~C~~A computer program having a program code for performing the method according to one of claims 16 - 18 when the computer program runs on a computer.

20. ~~A~~An audio signal ~~(135)~~ comprising:

a core encoded audio signal ~~(145)~~ having a reduced number of subbands with respect to an original audio signal ~~(55)~~;

a parameter ~~(190)~~ representing subbands of the audio signal not included in the core encoded audio signal ~~(145)~~;

a fundamental frequency estimate ~~(140)~~ of the audio signal ~~(135)~~ or the orginal audio signal ~~(55)~~.

21. ~~A~~The audio signal ~~(135)~~ according to claim 20,

wherein the audio signal ~~(135)~~ is formed into a sequence of frames, wherein each frame comprising the core encoded audio signal ~~(145)~~, the parameters ~~(190)~~, and wherein only each N^{th} frame comprising the fundamental frequency estimate ~~(140)~~, wherein N is greater or equal than 2.