Claims

1. Apparatus for generating an error concealment signal, comprising:

an LPC (linear prediction coding) representation generator (100) for generating a replacement LPC representation;

an LPC synthesizer (106, 108) for filtering a codebook information using the replacement LPC representation to obtain a replacement signal, from which the error concealment signal is derived; and

a noise estimator (206) for estimating a noise estimate during a reception of good audio frames, wherein the noise estimate depends on the good audio frames, and wherein the noise estimate is derived from a past decoded signal (208), and

wherein the LPC representation generator (100) is configured to use the noise estimate estimated by the noise estimator (206) in generating the replacement LPC representation.

2. Apparatus of claim 1,

wherein the noise estimator (206) is configured

to obtain (1200) the past decoded signal (208),

to calculate (1202) a spectral representation of the past decoded signal (208),

to derive (1204) a noise spectral representation from the spectral representation of the past decoded signal (208), and

to convert (1206) the noise spectral representation into a noise LPC representation, the noise LPC representation being the same kind of LPC representation as the replacement LPC representation.

3. Apparatus of claim 1 or 2,

wherein the replacement LPC representation comprises a replacement factor, and

wherein the noise estimator (206) is configured to provide the noise estimate as a noise factor.

4. Apparatus of claim 3, wherein the replacement factor is an LSF (line spectral frequency) factor or an ISF (immitance spectral frequency) factor and wherein the noise factor is an LSF factor or an ISF factor.

5. Apparatus of one of the preceding claims,

wherein the noise estimator (206) is configured for applying a minimum statistics approach with optimal smoothing (1210) to a past decoded signal (208) to derive the noise estimate.

6. Apparatus of one of the preceding claims,

wherein the noise estimator (206) is configured

to derive (1210), from the past decoded signal (208), a spectral noise estimate,

to convert (1212, 1214) the spectral noise estimate into an LPC representation; and

to convert (1216) the LPC representation into an ISF domain or an LSF domain to obtain the noise estimate.

7. Apparatus of one of the preceding claims,

wherein the noise estimator (206) is configured

to provide (1210) a spectral noise estimate;

to convert (1212) the spectral noise estimate into a time domain representation; and

to perform (1214) a Levinson-Durbin recursion using the first N samples of the time domain representation, wherein N corresponds to an LPC order of the representation.

8. Apparatus of claim 7,

wherein the time domain representation comprises an inverse of a squared Fourier Transform spectrum.

9. Apparatus of one of the preceding claims,

wherein the LPC representation generator (100) is configured to derive the replacement LPC representation using the noise estimate and a last good LPC representation.

10. Apparatus of one of the preceding claims,

wherein the LPC representation generator (100) is configured to derive the replacement LPC representation using a preceding good LPC representation or a mean value of at least two preceding good LPC representations, wherein the mean value or the preceding good LPC representation is faded out such that, after a number of erroneous or missing frames, the replacement LPC representation corresponds to the noise estimate.

11. Apparatus of one the preceding claims,

wherein the LPC representation generator (100) is configured to generate a further replacement LPC representation,

wherein the apparatus further comprises an adaptive codebook (104),

wherein the LPC synthesizer (106, 108) is configured to filter codebook information from a fixed codebook using the replacement LPC representation derived from the noise estimate to obtain a second replacement signal, and

wherein the LPC synthesizer (106, 108) is configured to filter a codebook information from the adaptive codebook using the further replacement LPC representation to obtain a first replacement signal, wherein the LPC representation generator (100) is configured to calculate the further replacement LPC representation using a mean value of at least two good LPC representations, and

wherein the apparatus further comprises a replacement signal combiner (110) configured to combining the first replacement signal and the second replacement signal to obtain the error concealment signal.

12. Apparatus of claim 11,

wherein the LPC representation generator (100) is configured to calculate the replacement LPC representation based on the following equation:

$$isf_B^{-1} = \alpha_B \cdot isf^{-2} + (1 - \alpha_B) \cdot isf^{cng},$$

wherein the LPC representation generator (100) is configured to calculate the further replacement LPC representation based on the following equation:

$$isf' = \frac{isf^{-2} + isf^{-3} + isf^{-4}}{3}$$
$$isf_A^{-1} = \alpha_A \cdot isf^{-2} + (1 - \alpha_A) \cdot isf',$$

wherein α_A and α_B are time-varying fading factors, wherein isf^{-2} is the LPC representation of the last good frame, wherein isf^{-3} is the LPC representation of the second last good frame, wherein isf^{-4} is the LPC representation of the third last good frame, wherein isf_B^{-1} is the replacement LPC representation, and wherein isf_A^{-1} is the further replacement LPC representation, wherein isf^{cng} is the noise estimate, and wherein ISF stands for values in an ISF domain or in an LSF domain.

13. Apparatus of one of the preceding claims, further comprising a signal analyzer (200) for analyzing a signal characteristic of a signal received before an occurrence of an error to be concealed, wherein the signal analyzer (200) is configured to provide an analysis result, and wherein the LPC representation generator (100) is configured to use a time-varying fading factor, wherein the time-varying fading factor is determined depending on the analysis result.

14. Apparatus of claim 13,

wherein the signal characteristic is a signal stability or a signal class, and

wherein the time-varying fading factor is determined so that the fading factor decreases to 0 in a shorter time for a signal being less stable or being in a noise class compared to a signal being more stable or being in a tonal class.

15. Apparatus of one of the preceding claims, further comprising:

a gain calculator (600) for calculating a gain information from the replacement LPC representation; and

a compensator (406, 408) for compensating a gain influence of the replacement LPC representation using the gain information,

wherein the compensator (406, 408) is configured for weighting a codebook information or an LPC synthesis output signal.

16. A method for generating an error concealment signal, comprising:

generating (100) a replacement LPC representation;

filtering (106, 108) a codebook information using the replacement LPC representation to obtain a replacement signal, from which the error concealment signal is derived; and

estimating (206) a noise estimate during a reception of good audio frames, wherein the noise estimate depends on the good audio frames, and wherein the noise estimate is derived from a past decoded signal (208), and

wherein the noise estimate estimated by the estimating (206) is used in generating (100) the replacement LPC representation.

17. Computer program for performing, when running on a computer or a processor, the method of claim 16.