Claims

1. An apparatus for generating spectral replacement values for an audio signal comprising:

a buffer unit for storing previous spectral values relating to a previously received error-free audio frame, and

a concealment frame generator for generating the spectral replacement values when a current audio frame has not been received or is erroneous, wherein the previously received error-free audio frame comprises filter information, the filter information having associated a ~~filter~~ stability value indicating a stability ~~of a prediction~~defined by the filter information, and wherein the concealment frame generator is adapted to generate the spectral replacement values based on the previous spectral values and based on the ~~filter~~ stability value.

2. An apparatus according to claim 1, wherein the concealment frame generator is adapted to generate the spectral replacement values by randomly flipping the sign of the previous spectral values.

3. An apparatus according to claim 1 or 2, wherein the concealment frame generator is configured to generate the spectral replacement values by multiplying each of the previous spectral values by a first gain factor when the ~~filter~~ stability value has a first value, and by multiplying each of the previous spectral values by a second gain factor, being smaller than the first gain factor, when the ~~filter~~ stability value has a second value being smaller than the first value.

4. An apparatus according to one of the preceding claims, wherein the ~~concealment frame generator is adapted to generate the spectral replacement values based on the filter stability value, wherein the~~ previously received error-free audio frame comprises first predictive filter coefficients of the prediction filter, wherein a predecessor frame of the previously received error-free audio frame comprises second predictive filter coefficients, and wherein the ~~filter~~ stability value depends on the first predictive filter coefficients and on the second predictive filter coefficients.

~~5. An apparatus according to claim 4, wherein the concealment frame generator is adapted to determine the filter stability value based on the first predictive filter~~

~~coefficients of the previously received error-free audio frame and based on the second predictive filter coefficients of the predecessor frame of the previously received error-free audio frame.~~

~~6~~5. An apparatus according to claim 4 ~~or 5, wherein the concealment frame generator is adapted to generate the spectral replacement values based on the filter stability value~~, wherein the ~~filter~~ stability value depends on a distance measure LSF_{dist}, and wherein the distance measure LSF_{dist} is defined by the formula:

$$LSF_{dist} = \sum_{i=0}^{u} (f_i - f_i^{(p)})^2$$

wherein u+1 specifies a total number of the first predictive filter coefficients of the previously received error-free audio frame, and wherein u+1 also specifies a total number of the second predictive filter coefficients of the predecessor frame of the previously received error-free audio frame, wherein f_i specifies the i-th filter coefficient of the first predictive filter coefficients and wherein $f_i^{(p)}$ specifies the i-th filter coefficient of the second predictive filter coefficients.

~~7~~6. An apparatus according to one of the preceding claims, wherein the concealment frame generator is adapted to generate the spectral replacement values furthermore based on frame class information ~~relating to~~indicating a classification of the previously received error-free audio frame.

~~8~~7. An apparatus according to claim ~~7, wherein the concealment frame generator is adapted to generate the spectral replacement values based on the frame class information~~6, wherein the frame class information indicates that the previously received error-free audio frame is classified as "artificial onset", "onset", "voiced transition", "unvoiced transition", "unvoiced" or "voiced".

~~9~~8. An apparatus according to one of the preceding claims, wherein the concealment frame generator is adapted to generate the spectral replacement values furthermore based on a number of consecutive frames that ~~did not arrive at a receiver or that~~ were erroneous, since a last error-free audio frame had arrived at the receiver, wherein no other error-free audio frames arrived at the receiver since the last error-free audio frame had arrived at the receiver.

~~10~~9. An apparatus according to claim ~~9~~8,

wherein the concealment frame generator is adapted to calculate a fade out factor, based on the ~~filter~~ stability value and based on the number of consecutive frames that ~~did not arrive at the receiver or that~~ were erroneous, and

wherein the concealment frame generator is adapted to generate the spectral replacement values by multiplying the fade out factor by at least some of the previous spectral values, or by at least some values of a group of intermediate values, wherein each one of the intermediate values depends on at least one of the previous spectral values.

~~11~~10. An apparatus according to one of the preceding claims, wherein the concealment frame generator is adapted to generate the spectral replacement values ~~based on the previous spectral values, based on the filter stability value and~~ also based on a prediction gain of a temporal noise shaping being conducted on the first intermediate spectral values to obtain second intermediate spectral values, wherein said prediction gain indicates a ratio depending on the second intermediate spectral values and depending on the first intermediate spectral values.

~~12~~11. An audio signal decoder comprising:

an apparatus for decoding ~~spectral audio signal values~~, and

an apparatus for generating spectral replacement values according to one of claims 1 to ~~11~~10,

wherein the apparatus for decoding ~~spectral audio signal values~~ is adapted to decode previous spectral values of an audio signal based on a previously received error-free audio frame, wherein the apparatus for decoding ~~spectral audio signal values~~ is furthermore adapted to store the previous spectral values of the audio signal in the buffer unit of the apparatus for generating spectral replacement values, and

wherein the apparatus for generating spectral replacement values is adapted to generate the spectral replacement values based on the previous spectral values stored in the buffer unit, when a current audio frame has not been received or is erroneous.

~~13~~12. An audio signal decoder~~, comprising:~~ according to claim 11,

~~a~~ wherein the apparatus for decoding ~~unit for generating~~is adapted to generate first intermediate spectral values based on ~~a~~the previously received error-free audio frame, and

wherein the audio signal decoder further comprises a temporal noise shaping unit for conducting temporal noise shaping on the first intermediate spectral values to obtain second intermediate spectral values,

wherein the audio signal decoder further comprises a prediction gain calculator for calculating a prediction gain of the temporal noise shaping, wherein said prediction gain indicates a ratio depending on the first intermediate spectral values and depending on the second intermediate spectral values, and

~~an apparatus according to one of claims 1 to 11, for generating spectral replacement values when a current audio frame has not been received or is erroneous, and~~

wherein the audio signal decoder further comprises a values selector for storing the first intermediate spectral values in the buffer unit of the apparatus for generating spectral replacement values, if the prediction gain is greater than or equal to a threshold value, or for storing the second intermediate spectral values in the buffer unit of the apparatus for generating spectral replacement values, if the prediction gain is smaller than the threshold value.

~~14~~13. An audio signal decoder~~, comprising:~~

~~a first decoding module for generating generated spectral values based on a received error-free audio frame,~~

~~an apparatus for generating spectral replacement values~~ according to ~~one of claims 1 to~~claim 11, ~~and~~

wherein the audio signal decoder further comprises a processing module for processing the ~~generated~~previous spectral values by conducting temporal noise shaping, applying noise-filling or applying a global gain, to obtain spectral audio values of the decoded audio signal,

wherein the apparatus for generating spectral replacement values is adapted to generate spectral replacement values and to feed them into the processing module, when a current frame has not been received or is erroneous.

~~15~~14. A method for generating spectral replacement values for an audio signal comprising:

storing previous spectral values relating to a previously received error-free audio frame, and

generating the spectral replacement values when a current audio frame has not been received or is erroneous, wherein the previously received error-free audio frame comprises filter information, the filter information having associated a ~~filter~~ stability value indicating a stability ~~of a prediction filter~~ defined by the filter information, wherein the spectral replacement values are generated based on the previous spectral values and based on the ~~filter~~ stability value.

~~16~~15. A computer program for implementing the method of claim ~~15~~14, when the computer program is executed by a computer or signal processor.