

Claims:

1. A transition mode device for use in a predictive-type sound signal codec for producing a transition mode excitation replacing an adaptive codebook excitation in at least one frame following a transition frame in the sound signal, comprising:
 - an input for receiving a codebook index; and
 - a transition mode codebook for generating a set of codevectors independent from past excitation, the transition mode codebook being responsive to the codebook index for generating, in the at least one frame following the transition frame, one of the codevectors of the set corresponding to said transition mode excitation;wherein the transition mode codebook comprises a codebook of glottal impulse shapes.
2. A transition mode device as defined in claim 1, wherein the sound signal comprises a speech signal and wherein the transition frame is selected from the group consisting of a frame comprising a voiced onset, and a frame comprising a transition between two different voiced sounds.
3. A transition mode device as defined in claim 1, wherein the at least one frame following the transition frame comprises a plurality of subframes, and wherein the transition mode codebook is used in a first part of the subframes and a predictive-type codebook of the predictive-type codec is used in a second part of the subframes.
4. A transition mode device for use in a predictive-type sound signal codec for producing a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in the sound signal, comprising:
 - an input for receiving a codebook index; and
 - a transition mode codebook for generating a set of codevectors independent from past excitation, the transition mode codebook being responsive to the codebook index for generating, in the transition frame and/or the at least one frame following the transition, one of the codevectors of the set corresponding to said transition mode excitation;wherein the transition mode codebook comprises a codebook of glottal impulse shapes, wherein the transition frame and/or the at least one frame following the transition each comprise a plurality of subframes, and wherein the transition mode codebook is used only in the subframe containing a first glottal impulse of a current frame.
5. A transition mode device as defined in claim 4, comprising means for producing, in at least one subframe preceding the subframe using the transition mode codebook, a global excitation signal comprising exclusively an innovation codebook component.
6. A transition mode device ~~as defined in claim 1, for use in a predictive-type sound signal codec for producing a transition mode excitation replacing an adaptive codebook excitation in a~~

~~transition frame and/or at least one frame following the transition in the sound signal, comprising:~~

~~an input for receiving a codebook index; and~~

~~a transition mode codebook for generating a set of codevectors independent from past excitation, the transition mode codebook being responsive to the codebook index for generating, in the transition frame and/or the at least one frame following the transition, one of the codevectors of the set corresponding to said transition mode excitation;~~

~~wherein the transition mode codebook comprises a codebook of glottal impulse shapes, wherein the codebook of glottal impulse shapes includes a predetermined number of different shapes of glottal impulses, and wherein each shape of glottal impulse is positioned at a plurality of different positions in the codevectors to form a plurality of different codevectors of the codebook of glottal impulse shapes.~~

7. A transition mode device as defined in claim 6, wherein the codebook of glottal impulse shapes comprises a generator of codevectors containing only one non-zero element and a shaping filter for processing the codevectors containing only one non-zero element to produce codevectors representing glottal impulse shapes centered at different positions.
8. A transition mode device as defined in claim 7, wherein the transition frame and/or the at least one frame following the transition each comprise a plurality of subframes, the codebook of glottal impulse shapes further comprises a repetition filter positioned downstream of the shaping filter for repeating, when there are more than one glottal impulse per subframe, the glottal impulse shape after a pitch period has elapsed.
9. A transition mode device as defined in claim 6, wherein the glottal impulse shapes comprise first and last samples wherein a predetermined number of the first and last samples are truncated.
10. An encoder device for generating a transition mode excitation replacing an adaptive codebook excitation in at least one frame following a transition frame in a sound signal, comprising:
 - a generator of a codebook search target signal;
 - a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the codevectors of said set each corresponds to a respective transition mode excitation and wherein the transition mode codebook comprises a codebook of glottal impulse shapes;
 - a searcher of the transition mode codebook for finding the codevector of said set corresponding to a transition mode excitation optimally corresponding to the codebook search target signal.
11. An encoder device as defined in claim 10, wherein the searcher applies a given criterion to every glottal impulse shape of the codebook of glottal impulse shapes and finds as the codevector optimally corresponding to the codebook search target signal the codevector of the set corresponding to a maximum value of said criterion.

12. An encoder device as defined in claim 11, wherein the searcher identifies the found codevector by means of transition mode parameters selected from the group consisting of a transition mode configuration identification, a glottal impulse shape, a position of the glottal impulse shape centre in the found codevector, a transition mode gain, a sign of the transition mode gain and a closed-loop pitch period.
13. An encoder device as defined in claim 10, wherein the sound signal comprises a speech signal and wherein the transition frame is selected from the group consisting of a frame comprising a voiced onset, and a frame comprising a transition between two different voiced sounds.
14. An encoder device as defined in claim 10, wherein the at least one frame following the transition frame comprises a plurality of subframes, and wherein the searcher searches the transition mode codebook in a first part of the subframes and a predictive-type codebook of the encoder device in a second part of the subframes.
15. An encoder device for generating a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in a sound signal, comprising:
 - a generator of a codebook search target signal;
 - a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the codevectors of said set each corresponds to a respective transition mode excitation and wherein the transition mode codebook comprises a codebook of glottal impulse shapes;
 - a searcher of the transition mode codebook for finding the codevector of said set corresponding to a transition mode excitation optimally corresponding to the codebook search target signal,wherein the transition frame and/or the at least one frame following the transition each comprise a plurality of subframes, and wherein the transition mode codebook is used only in the subframe containing a first glottal impulse of a current frame.
16. An encoder device as defined in claim 15, comprising means for producing, in at least one subframe preceding the subframe using the transition mode codebook, a global excitation signal comprising exclusively an innovation codebook component.
17. An encoder device ~~as defined in claim 10, for generating a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in a sound signal, comprising:~~
 - ~~a generator of a codebook search target signal;~~
 - ~~a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the codevectors of said set each corresponds to a respective transition mode excitation and wherein the transition mode codebook comprises a codebook of glottal impulse shapes;~~
 - ~~a searcher of the transition mode codebook for finding the codevector of said set corresponding to a transition mode excitation optimally corresponding to the codebook search target signal,~~

wherein the codebook of glottal impulse shapes includes a predetermined number of different shapes of glottal impulses, and wherein each shape of glottal impulse is positioned at a plurality of different positions in the codevectors to form a plurality of different codevectors of the codebook of glottal impulse shapes.

18. An encoder device as defined in claim 17, wherein the codebook of glottal impulse shapes comprises a generator of codevectors containing only one non-zero element and a shaping filter for processing the codevectors containing only one non-zero element to produce codevectors representing glottal impulse shapes centered at different positions.
19. An encoder device as defined in claim 10, further comprising:
 - a generator of an innovation codebook search target signal;
 - an innovation codebook for generating a set of innovation codevectors each corresponding to a respective innovation excitation;
 - a searcher of the innovation codebook for finding the innovation codevector of said set corresponding to an innovation excitation optimally corresponding to the innovation codebook search target signal; and
 - an adder of the transition mode excitation and the innovation excitation to produce a global excitation for a sound signal synthesis filter;wherein the at least one frame following the transition frame comprises a plurality of subframes and wherein, depending on where a glottal impulse or impulses are located in the subframes, the encoder device comprises means for encoding the subframes using at least one of the transition mode codebook, the adaptive codebook and the innovation codebook.
20. A decoder device comprising the transition mode device as defined in any one of claims 1 to 9, for producing the transition mode excitation replacing the adaptive codebook excitation in the at least one frame following the transition frame in the sound signal.
21. A decoder device as defined in claim 20, further comprising:
 - an input for receiving an innovation codebook index;
 - an innovation codebook for generating a set of innovation codevectors, the innovation codebook being responsive to the innovation codebook index for generating the at least one frame following the transition frame one of the innovation codevectors of the set corresponding to an innovation excitation;
 - an adder of the transition mode excitation and the innovation excitation to produce a global excitation for a sound signal synthesis filter.
22. A transition mode method for use in a predictive-type sound signal codec for producing a transition mode excitation replacing an adaptive codebook excitation in at least one frame following a transition frame in the sound signal, comprising:

providing a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the transition mode codebook comprises a codebook of glottal impulse shapes;

supplying a codebook index to the transition mode codebook; and

generating, by means of the transition mode codebook and in response to the codebook index, one of the codevectors of the set corresponding to said transition mode excitation.

23. A transition mode method as defined in claim 22, wherein the sound signal comprises a speech signal and said method comprises selecting the transition frame from the group consisting of a frame comprising a voiced onset, and a frame comprising a transition between two different voiced sounds.

24. A transition mode method as defined in claim 22, wherein the at least one frame following the transition frame comprises a plurality of subframes, and said method comprises using the transition mode codebook in a first part of the subframes and a predictive-type codebook of the predictive-type codec in a second part of the subframes.

25. A transition mode method for use in a predictive-type sound signal codec for producing a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in the sound signal, comprising:

providing a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the transition mode codebook comprises a codebook of glottal impulse shapes;

supplying a codebook index to the transition mode codebook; and

generating, by means of the transition mode codebook and in response to the codebook index, one of the codevectors of the set corresponding to said transition mode excitation,

wherein the transition frame and/or the at least one frame following the transition each comprise a plurality of subframes, and wherein said method comprises using the transition mode codebook only in the subframe containing a first glottal impulse of a current frame.

26. A transition mode method as defined in claim 25, comprising producing, in at least one subframe preceding the subframe using the transition mode codebook, a global excitation signal comprising exclusively an innovation codebook component.

27. A transition mode method ~~as defined in claim 22, for use in a predictive-type sound signal codec for producing a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in the sound signal, comprising:~~

~~providing a transition mode codebook for generating a set of codevectors independent from past excitation, wherein the transition mode codebook comprises a codebook of glottal impulse shapes;~~

~~supplying a codebook index to the transition mode codebook; and
generating, by means of the transition mode codebook and in response to the codebook index, one
of the codevectors of the set corresponding to said transition mode excitation;~~

wherein the codebook of glottal impulse shapes includes a predetermined number of different shapes of glottal impulses, and wherein the transition mode method comprises forming in the codebook of glottal impulse shapes a plurality of different codevectors by positioning each shape of glottal impulse at a plurality of different positions in the codevector.

28. A transition mode method as defined in claim 27, comprising, in the codebook of glottal impulse shapes, generating codevectors containing only one non-zero element and processing through a shaping filter the codevectors containing only one non-zero element to produce codevectors representing glottal impulse shapes centered at different positions.
29. An encoding method for generating a transition mode excitation replacing an adaptive codebook excitation in at least one frame following a transition frame in a sound signal, comprising:
 - generating a codebook search target signal;
 - providing a transition mode codebook for generating a set of codevectors independent from past excitation, the codevectors of said set each corresponding to a respective transition mode excitation, wherein the transition mode codebook comprises a codebook of glottal impulse shapes;
 - searching the transition mode codebook for finding the codevector of said set corresponding to a transition mode excitation optimally corresponding to the codebook search target signal.
30. An encoding method as defined in claim 29, wherein searching the transition mode codebook comprises applying a given criterion to every glottal impulse shape of the codebook of glottal impulse shapes and finding as the codevector optimally corresponding to the codebook search target signal the codevector of the set corresponding to a maximum value of said criterion.
31. An encoding method as defined in claim 29, wherein the sound signal comprises a speech signal and said method further comprises selecting the transition frame from the group consisting of a frame comprising a voiced onset and a frame comprising a transition between two different voiced sounds.
32. An encoding method as defined in claim 29, wherein the at least one frame following the transition frame comprises a plurality of subframes, and wherein searching the transition mode codebook comprises searching the transition mode codebook in a first part of the subframes and searching a predictive-type codebook of the encoder device in a second part of the subframes.
33. An encoding method for generating a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in a sound signal, comprising:

generating a codebook search target signal;

providing a transition mode codebook for generating a set of codevectors independent from past excitation, the codevectors of said set each corresponding to a respective transition mode excitation, wherein the transition mode codebook comprises a codebook of glottal impulse shapes;

searching the transition mode codebook for finding the codevector of said set corresponding to a transition mode excitation optimally corresponding to the codebook search target signal,

wherein the transition frame and/or the at least one frame following the transition each comprise a plurality of subframes, and wherein said method comprises using the transition mode codebook only in the subframe containing a first glottal impulse of a current frame.

34. An encoding method as defined in claim 33, comprising producing, in at least one subframe preceding the subframe using the transition mode codebook, a global excitation signal comprising exclusively an innovation codebook component.

35. An encoding method ~~as defined in claim 29, for generating a transition mode excitation replacing an adaptive codebook excitation in a transition frame and/or at least one frame following the transition in a sound signal, comprising:~~

~~generating a codebook search target signal;~~

~~providing a transition mode codebook for generating a set of codevectors independent from past excitation, the codevectors of said set each corresponding to a respective transition mode excitation, wherein the transition mode codebook comprises a codebook of glottal impulse shapes;~~

~~searching the transition mode codebook for finding the codevector of said set corresponding to a transition mode excitation optimally corresponding to the codebook search target signal,~~

wherein the codebook of glottal impulse shapes includes a predetermined number of different shapes of glottal impulses, and the encoding method comprises forming a plurality of different codevectors of the codebook of glottal impulse shapes by positioning each shape of glottal impulse at a plurality of different positions in the codevectors.

36. An encoding method as defined in claim 35, wherein generating in the glottal-impulse-shape codebook the set of codevectors independent from past excitation comprises generating codevectors containing only one non-zero element and processing through a shaping filter the codevectors containing only one non-zero element to produce codevectors representing glottal impulse shapes centered at different positions.

37. An encoding method as defined in claim 29, further comprising:

generating an innovation codebook search target signal;

providing an innovation codebook for generating a set of innovation codevectors each corresponding to a respective innovation excitation;

searching the innovation codebook for finding the innovation codevector of said set corresponding to an innovation excitation optimally corresponding to the innovation codebook search target signal; and

adding the transition mode excitation and the innovation excitation to produce a global excitation for a sound signal synthesis filter;

wherein the the at least one frame following the transition frame comprises a plurality of subframes and wherein, depending on where the glottal impulse or impulses are located in the subframes, the encoding method comprises encoding the subframes using at least one of the transition mode codebook, the adaptive codebook and the innovation codebook.

38. A decoding method comprising the transition method as defined in any one of claims 22 to 24 for producing the transition mode excitation replacing the adaptive codebook excitation in the at least one frame following the transition frame in the sound signal.

39. A decoding method comprising the transition method as defined in any one of claims 25 to 28 for producing the transition mode excitation replacing the adaptive codebook excitation in the transition frame and/or the at least one frame following the transition in the sound signal.

40. A decoding method as defined in claim 38 or 39, further comprising:

providing an innovation codebook for generating a set of innovation codevectors;

supplying an innovation codebook index to the innovation codebook;

generating, by means of the innovation codebook and in response to the innovation codebook index, one of the innovation codevectors of the set corresponding to an innovation excitation; and

adding the transition mode excitation and the innovation excitation to produce a global excitation for a sound signal synthesis filter.