

Claims

1. Channel encoder for encoding a frame, comprising:

5 a multi-mode redundancy encoder for redundancy encoding the frame in accordance with a certain coding mode from a set of different coding modes, wherein the multi-mode redundancy encoder is configured to be capable of encoding the frame using each coding mode in the set,

10 wherein the coding modes are different from each other with respect to an amount of redundancy added to the frame, wherein the multi-mode redundancy encoder is configured to output a coded frame including at least one code word; and

a colorator for applying a coloration sequence to the at least one code word;

15 wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one of coloration sequence, wherein the colorator is configured to select the specific coloration sequence in accordance with the certain coding mode,

20 wherein the channel encoder further comprises:

a data splitter for splitting the frame into a plurality of data words, wherein the multi-mode redundancy encoder is configured to encode each of the plurality of data words according
25 to the certain coding mode to obtain a plurality of code words,

wherein the colorator is configured to apply the specific coloration sequence to each code word in a predefined number of the code words or in a predefined subset of the plurality of code words.

30 ~~1. Channel encoder for encoding a frame, comprising:~~

~~a multi-mode redundancy encoder for redundancy encoding the frame in accordance with a certain coding mode from a set of different coding modes,~~

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~~wherein the coding modes are different from each other with respect to an amount of redundancy added to the frame, wherein the multi-mode redundancy encoder is configured to output a coded frame including at least one code word; and~~

5 ~~a colorator for applying a coloration sequence to the at least one code word;~~

~~wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one of coloration sequence, wherein the specific coloration sequence is selected in accordance with the certain coding mode.~~

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2. Channel encoder according to claim 1, wherein the multi-mode redundancy encoder is configured to apply the certain coding mode in a previous frame, the first coding mode having associated therewith the coloration sequence, wherein the multi-mode redundancy encoder is configured to receive, for a current frame, an indication to use a second encoding
15 mode having associated therewith a further coloration sequence, and wherein the colorator is configured to apply the further coloration sequence in the current frame, or

wherein the further coloration being bypassed with a coloration sequence in the current frame.

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3. Channel encoder according to claim 1 or 2, further comprising:

a controller for providing coding criteria, wherein the coding criteria defines a redundancy rate of the frame, wherein the multi-mode redundancy encoder is configured to add
25 redundancy to the frame in accordance with the redundancy rate defined by the certain coding mode and a variable or fixed target size of the coded frame.

4. Channel encoder according to claim 3, wherein the multi-mode encoder is configured to determine the coding mode based on a required data protection strength,

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wherein the controller is configured to determine the required data protection strength based on an estimated error occurrence of a transmitted channel.

5. Channel encoder according to claims ~~3 or 4~~ 3 or 4, wherein the controller is configured to
35 switch the certain coding mode used for encoding the frame, and to generate coding mode information indicating the certain coding mode,

wherein the multi-mode redundancy encoder is configured to receive the coding mode information and perform redundancy encoding to obtain the at least one code word in accordance with the certain coding mode indicated by the received coding mode information,

wherein the colorator is configured to receive an indication for indicating the specific coloration sequence and to apply the indicated specific coloration sequence to the at least one code word.

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6. Channel encoder according to claim 5, wherein the colorator is configured to receive the indication for indicating the specific coloration sequence either from the controller or from the multi-mode redundancy encoder.

15 7. Channel encoder according to claims 1 to 6, wherein the colorator is configured to perform the coloration of the at least one code word by calculating a bit-wise XOR of the at least one code word and the specific coloration sequence.

~~8. Channel encoder according to claims 1 to 7, comprising:~~

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~~a data splitter for splitting the frame into a plurality of data words, wherein the multi-mode redundancy encoder is configured to encode each of the plurality of data words according to the certain coding mode to obtain a plurality of code words,~~

~~25 wherein the colorator is configured to apply the specific coloration sequence to each code word in a predefined subset of the plurality of code words.~~

89. Channel encoder according to claims 1 to 78, wherein the data splitter is configured to calculate the number of code words based on a target size for the frame, wherein a length of the data word, which is included in the code word, is changed based on the calculated number of the code words.

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910. Channel encoder according to any of claims 1 to 89, comprising:

an audio/video encoder for encoding an audio/video frame data, wherein the audio/video encoder is configured to set a set of audio/video frame data based on the certain [coding](#) mode.

- 5 [1011](#). Channel encoder according to claims 1 to [109](#), comprising:

a pre-processor for calculating a hash value on the audio/video frame, wherein the pre-processor is configured to concatenate the hash value and the audio/video frame.

- 10 [1112](#). Channel encoder according to claims [18](#) to [1011](#), wherein the data splitter is configured to split the frame, wherein at least one data word consists of the at least a part of the hash value and a part of the audio/video frame.

~~13. Channel encoder for encoding a frame, comprising:~~

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~~a multi-mode redundancy encoder for redundancy encoding the frame in accordance with a certain coding mode from a set of different coding modes, wherein the multi-mode redundancy encoder is configured to be capable of encoding the frame using each coding mode in the set;~~

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~~wherein the coding modes are different from each other with respect to an amount of redundancy added to the frame, wherein the multi-mode redundancy encoder is configured to output a coded frame including at least one code word; and~~

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~~a colorator for applying a coloration sequence to the at least one code word;~~

~~wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one of coloration sequence, wherein the colorator is configured to select the specific coloration sequence in accordance with the certain coding mode;~~

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~~wherein the channel encoder further comprises:~~

~~a data splitter for splitting the frame into a plurality of data words, wherein the multi-mode redundancy encoder is configured to encode each of the plurality of data words according to the certain coding mode to obtain a plurality of code words;~~

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~~wherein the colorator is configured to apply the specific coloration sequence to each code word in a predefined number of the code words or in a predefined subset of the plurality of code words.~~

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12. Channel decoder for channel decoding at least one transmitted code word, comprising:

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a colorator for applying at least one coloration sequence to the at least one transmitted code word or to an error corrected at least one transmitted code word to obtain at least one colored code word,

wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, and

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wherein the at least one coloration sequence is associated to a certain decoding mode as a specific coloration sequence;

a redundancy decoder for redundancy decoding the at least one colored code word to obtain a decoded output code word; and

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a decoding mode detector for generating a decoding mode indicator indicating the certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word,

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wherein the decoding mode indicator is associated to the at least one coloration sequence as the specific coloration sequence used for the coloration of the transmitted code word,

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wherein the redundancy decoder comprises a bit number reducer for reducing the bit number of the at least one colored code word and an error corrector for correcting an error of the colored code word, or the channel decoder further comprises an error corrector for correcting an error of the at least one transmitted code word,

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wherein the colorator is configured to use, in addition to the coloration sequence, at least a further coloration sequence, or wherein the channel decoder is configured to bypass the colorator in a further decoding mode without any coloration,

wherein the redundancy decoder is configured to redundancy decode an additional at least one colored code word colored using the further coloration sequence, to obtain a further decoded code word, the further colored code word which obtained from the transmitted code word using the further coloration sequence, or the transmission code word without coloration to obtain an even further decoded code word,

wherein the redundancy decoder is configured to output a reliability measure for the decoded code word, a further reliability measure for the further decoded code word or an even further reliability measure for the even further code word,

wherein the decoding mode detector is configured to determine, based on the reliability measures, the decoding mode indicator,

wherein the redundancy decoder is configured to receive the decoding mode indicator and to output as the decoded output code word, either the decoded code word, the further decoded code word, or the even further decoded code word,

wherein the colorator is configured to perform the coloration operation with the same coloration sequence to a predetermined number of the transmitted code words to obtain a predetermined number of the colored code words, and to perform the further coloration operation with the same further coloration sequence to a further predetermined number of the transmitted code words to obtain a predetermined number of the further colored code words, and

wherein the redundancy decoder is configured to determine the reliability measure deriving the predetermined number of the decoded code word, the further reliability measure deriving the predetermined number of the further decoded code word, or the even further reliability measure deriving the predetermined number of the decoded code word.

14. Channel decoder for channel decoding at least one transmitted code word, comprising:

a colorator for applying at least one coloration sequence to the at least one transmitted code word or to an error corrected at least one transmitted code word to obtain at least one colored code word,

wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, and

wherein the at least one coloration sequence is associated to a certain decoding mode as a specific coloration sequence;

5 a redundancy decoder for redundancy decoding the at least one colored code word to obtain a decoded output code word; and

10 a decoding mode detector for generating a decoding mode indicator indicating the certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word;

wherein the decoding mode indicator is associated to the at least one coloration sequence as the specific coloration sequence used for the coloration of the transmitted code word.

15 15. Channel decoder according to claim 14, wherein the redundancy decoder comprises a bit number reducer for reducing the bit number of the at least one colored code word and an error corrector for correcting an error of the colored code word, or

20 the channel decoder further comprises an error corrector for correcting an error of the at least one transmitted code word.

25 16. Channel decoder according to claim 14 or 15, wherein the colorator is configured to use, in addition to the coloration sequence, at least a further coloration sequence, or wherein the channel decoder is configured to bypass the colorator in a further decoding mode without any coloration;

30 wherein the redundancy decoder is configured to redundancy decode an additional at least one colored code word colored using the further coloration sequence, to obtain a further decoded code word, the further colored code word which obtained from the transmitted code word using the further coloration sequence, or the transmission code word without coloration to obtain an even further decoded code word, and

35 wherein the redundancy decoder is configured to output a reliability measure for the decoded code word, a further reliability measure for the further decoded code word or an even further reliability measure for the even further code word,

~~wherein the decoding mode detector is configured to determine, based on the reliability measures, the decoding mode indicator, and~~

5 ~~wherein the redundancy decoder is configured to receive the decoding mode indicator and to output as the decoded output code word, either the decoded code word, the further decoded code word, or the even further decoded code word.~~

10 13-17. Channel decoder according to claims 12-14 to 16, wherein the decoding mode detector is configured to calculate a hash value of the decoded frame, to compare the hash value of the decoded frame and a hash value associated with the transmitted code word, and to determine the decoding mode indicator based on a result of a hash comparison,

wherein the colorator is configured to bypass the coloration operation, and

15 wherein the redundancy decoder is configured to receive the transmitted code word using no coloration sequence and to perform the redundancy decoding operation in accordance with the decoding mode indicator.

20 14-18. Channel decoder according to claim 12-14 to 16, wherein the colorator is configured to perform a plurality of coloration operations, at least to obtain the colored code word and to obtain the further colored code word in parallel,

25 wherein the redundancy decoder is configured to perform a plurality of redundancy decoding operations, at least to obtain the decoded code word, to obtain the further decoded code word and even further code word in parallel,

the channel decoder further comprising:

30 a controller for controlling output of the redundancy decoder, wherein the controller is configured to instruct to the redundancy decoder to output either the decoded code word, the further decoded code word or even further decoded code word as the decoded output code word.

35 15. Channel decoder according to claim 14, wherein the controller is configured to instruct the redundancy decoder to select the certain decoding mode having the highest reliability measure, or

to instruct the output interface to select, as the decoded output code word, a decoded code word from a group of decoded code words further using different decoding modes, wherein the selected code word associates therewith has the highest reliability measure.

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16+19. Channel decoder according to claims s 12+16 to 15+18, wherein the redundancy decoder is configured to calculate the reliability measure based on the number of the corrected symbols during a decoding operation of the colored code word, the further reliability measure based on the number of the corrected symbols during a further decoding operation of the further code word, and the reliability measure based on the number of the corrected symbols during an even further decoding operation of the even further code word.

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~~20. Channel decoder according to claims 16 to 19, wherein the colorator is configured to perform the coloration operation with the same coloration sequence to a predetermined number of the transmitted code words to obtain a predetermined number of the colored code words, and to perform the further coloration operation with the same further coloration sequence to a further predetermined number of the transmitted code words to obtain a predetermined number of the further colored code words,~~

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~~wherein the redundancy decoder is configured to determine the reliability measure deriving the predetermined number of the decoded code word, the further reliability measure deriving the predetermined number of the further decoded code word, or the even further reliability measure deriving the predetermined number of the decoded code word.~~

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17+21. Channel decoder according to claims s 12 to 16+20, wherein the predetermined number of the transmitted code words is between 3 and 9.

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18+22. Channel decoder according to claims 14+18 to 17+21, wherein the controller is configured

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to indicate the redundancy decoder to select the certain decoding mode using the reliability measure, or

to indicate an output interface to output either the decoded code word as the decoded output code word.

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~~23. Channel decoder according to claim 22, wherein the controller is configured to instruct the redundancy decoder to select the certain decoding mode having the highest reliability measure, or~~

5 ~~to instruct the output interface to select, as the decoded output code word, a decoded code word from a group of decoded code words further using different decoding modes, wherein the selected code word associates therewith has the highest reliability measure.~~

~~24. Channel decoder for channel decoding at least one transmitted code word, comprising:~~

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~~a colorator for applying at least one coloration sequence to the at least one transmitted code word or to an error corrected at least one transmitted code word to obtain at least one colored code word;~~

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~~wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, and~~

~~wherein the at least one coloration sequence is associated to a certain decoding mode as a specific coloration sequence;~~

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~~a redundancy decoder for redundancy decoding the at least one colored code word to obtain a decoded output code word; and~~

~~a decoding mode detector for generating a decoding mode indicator indicating the certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word;~~

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~~wherein the decoding mode indicator is associated to the at least one coloration sequence as the specific coloration sequence used for the coloration of the transmitted code word;~~

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~~wherein the colorator is configured to use, in addition to the coloration sequence, at least a further coloration sequence, or wherein the channel decoder is configured to bypass the colorator in a further decoding mode without any coloration;~~

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~~wherein the redundancy decoder is configured to redundancy decode an additional at least one colored code word colored using the further coloration sequence, to obtain a further~~

~~decoded code word, the further colored code word which obtained from the transmitted code word using the further coloration sequence, or the transmission code word without coloration to obtain an even further decoded code word, and~~

5 ~~wherein the redundancy decoder is configured to output a reliability measure for the decoded code word, a further reliability measure for the further decoded code word or an even further reliability measure for the even further code word,~~

10 ~~wherein the decoding mode detector is configured to determine, based on the reliability measures, the decoding mode indicator, and~~

~~wherein the redundancy decoder is configured to receive the decoding mode indicator and to output as the decoded output code word, either the decoded code word, the further decoded code word, or the even further decoded code word,~~

15 ~~wherein the colorator is configured to perform the coloration operation with the same coloration sequence to a predetermined number of the transmitted code words to obtain a predetermined number of the colored code words, and to perform the further coloration operation with the same further coloration sequence to a further predetermined number of~~
 20 ~~the transmitted code words to obtain a predetermined number of the further colored code words,~~

~~wherein the redundancy decoder is configured to determine the reliability measure deriving the predetermined number of the decoded code word, the further reliability measure deriving the predetermined number of the further decoded code word, or the even further reliability measure deriving the predetermined number of the decoded code word.~~

19. Channel decoder for channel decoding at least one transmitted code word, comprising:
 30 a colorator for applying at least one coloration sequence to the at least one transmitted code word or to an error corrected at least one transmitted code word to obtain at least one colored code word,

35 wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, and

wherein the at least one coloration sequence is associated to a certain decoding mode as a specific coloration sequence;

5 a redundancy decoder for redundancy decoding the at least one colored code word to obtain a decoded output code word; and

a decoding mode detector for generating a decoding mode indicator indicating the certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word,

10 wherein the decoding mode indicator is associated to the at least one coloration sequence as the specific coloration sequence used for the coloration of the transmitted code word,

15 wherein the redundancy decoder comprises a bit number reducer for reducing the bit number of the at least one colored code word and an error corrector for correcting an error of the colored code word, or the channel decoder further comprises an error corrector for correcting an error of the at least one transmitted code word,

20 wherein the decoding mode detector is configured to store a candidate list indicating a predetermined number of candidate decoding modes, wherein one candidate decoding mode is indicated without any coloration sequence and the other respective candidate decoding modes are indicated in association with a coloration sequence, and to select one candidate decoding mode as a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word to be used,

25 wherein the decoding mode detector is configured to perform a first decoding mode operation and a second decoding mode operation,

30 wherein the decoding mode detector for performing the first decoding mode operation is configured to estimate the certain decoding mode being the candidate decoding mode without coloration sequence, to calculate syndromes of the code word, to check whether the calculated syndromes have value zero,

35 when the calculated syndromes have value zero, to calculate a hash value of the transmitted code word, to compare the calculated hash value and a hash value included in the transmitted code word, and

when the calculated hash value is equal to the included hash value, to generate the decoding mode indicator to indicate the candidate coding mode without coloration sequence as the certain decoding mode, or

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when the calculated hash value is different from the included hash value, to exclude the candidate decoding mode without coloration sequence from the candidate list, and to proceed further with the second decoding mode operation.

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~~25. Channel decoder according to claim 14, wherein the decoding mode detector is configured to store a candidate list indicating a predetermined number of candidate decoding modes, wherein one candidate decoding mode is indicated without any coloration sequence and the other respective candidate decoding modes are indicated in association with a coloration sequence, and to select one candidate decoding mode as a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word to be used,~~

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~~wherein the decoding mode detector is configured to perform a first decoding mode operation and a second decoding mode operation,~~

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~~wherein the decoding mode detector for performing the first decoding mode operation is configured to estimate the certain decoding mode being the candidate decoding mode without coloration sequence, to calculate syndromes of the code word, to check whether the calculated syndromes have value zero,~~

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~~when the calculated syndromes have value zero, to calculate a hash value of the transmitted code word, to compare the calculated hash value and a hash value included in the transmitted code word, and~~

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~~when the calculated hash value is equal to the included hash value, to generate the decoding mode indicator to indicate the candidate coding mode without coloration sequence as the certain decoding mode, or~~

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~~when the calculated hash value is different from the included hash value, to exclude the candidate decoding mode without coloration sequence from the candidate list, and to proceed further with the second decoding mode operation.~~

[2026](#). Channel decoder according to claim [1925](#), wherein the decoding mode detector comprises, for performing the second decoding mode operation:

a syndrome calculator for calculating a syndrome for the at least transmitted code word,

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a syndrome colorator for applying a coloration sequence in association with the candidate decoding modes on the candidate list to obtain colored syndromes,

wherein the syndrome colorator is configured to apply coloration sequences association with every candidate decoding mode on the candidate list to the syndrome, and

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a syndrome checker for testing whether colored syndromes have value zero to obtain a result of the syndrome check,

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wherein the decoding mode detector is configured to generate the decoding mode indicator based on the result of the syndrome check.

[2127](#). Channel decoder according to claim [2026](#), wherein the decoding mode detector comprises, for performing the second decoding mode operation:

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an error locator polynomial calculator for calculating an error locator polynomial based on the syndrome in every candidate decoding modes on the candidate list; and

a risk value calculator for calculating a risk value of the transmitted code word in every candidate decoding mode on the candidate list based on the syndrome and the error locator polynomial, wherein the decoding mode detector is configured to generate the decoding mode indicator based on the risk value.

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[2228](#). Channel decoder according to claim [2327](#), wherein the decoding mode detector is configured to evaluate the risk value of the transmitted code word in every candidate decoding mode on the candidate list to compare to a predetermined threshold, and to exclude the candidate decoding mode from the candidate list, when the candidate decoding mode corresponding risk value is larger than the threshold.

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[2329](#). Channel decoder according to claims [2026](#) to [2228](#) wherein the decoding mode detector is configured to select the candidate decoding mode as the certain decoding mode,

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the candidate decoding mode corresponds to the risk value having the smallest value, and to generate the decoding mode indicator indicating the certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word.

- 5 [2430](#). Channel decoder according to claims [2127](#) to [2329](#), wherein the decoding mode detector comprises, for performing the second decoding mode operation:

an error position calculator for calculating an error position in the candidate decoding mode by factorizing the error location polynomial,

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wherein the decoding mode detector is configured to receive a result of the error location polynomial factorization and to generate the decoding mode indicator based on the result of the error location polynomial factorization.

- 15 [2531](#). Channel decoder according to claim [2430](#), wherein the decoding mode detector is configured to exclude the candidate decoding mode from the candidate list, when a result of the error location polynomial factorization in the candidate decoding mode is not obtained.

- 20 [2632](#). Channel decoder according to claim [2430](#) or [2531](#), wherein the decoding mode detector is configured to generate the decoding mode indicator to instruct to select the candidate decoding mode in association with a result of the error location polynomial factorization.

- 25 [2733](#). Channel decoder according to claims [2430](#) to [2632](#), wherein the decoding mode detector comprises, for performing the second decoding mode operation:

an error symbol calculator for calculating an error symbol in the every candidate decoding mode based on the syndrome in the candidate decoding mode and the calculated error position in the same candidate decoding mode,

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wherein the decoding mode detector is configured to receive the error symbol of the transmitted code word in the selected candidate decoding mode, and to generate the decoding mode indicator including the error symbol of the transmitted code word.

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- [2834](#). Channel decoder according to claim [2733](#), comprising:

an error corrector for correcting an error of the transmitted code word,

5 wherein the error corrector is configured to correct the error symbol indicated by the error symbol calculator.

2935. Channel decoder according to claim 2733 or 2834, wherein

10 the decoding mode detector is configured to generate the decoding mode indicator indicating to mark a frame as a bad frame,

when all the candidate decoding modes are excluded from the candidate list, or

15 when an error symbol in the transmitted code word is not correctable.

3036. Channel decoder according to claims 1214 to 2935, comprising:

an input interface to receive a coded frame including a plurality number of the transmitted code words,

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wherein the plurality number of the transmitted code words is at least two to eight.

3137. Channel decoder according to claims 1925 to 3036, wherein the decoding mode detector is configured to provide the decoding mode indicator to the colorator and the redundancy decoder,

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wherein the colorator is configured to select a coloration sequence indicated by the decoding mode indicator,

30 wherein the redundancy decoder is configured to select the certain decoding mode indicated by the decoding mode indicator.

3238. Channel decoder according to claim 3137, further comprising:

35 a de-multiplexer or de-interleaver for de-multiplexing or de-interleaving a received code word to obtain the at least one transmitted code word.

[3339](#). Channel decoder according to claim [3137](#) or [3238](#), further comprising:

a data combiner for combining a plurality of the decoded output code words to obtain an audio/video frame data.

[3440](#). Channel decoder according to claim [3339](#), further comprising:

a post processor for determining a frame data to be outputted by re-calculating a hash value of the obtained audio/video frame to compare with a hash value included in the frame data.

[3541](#). The channel decoder according to claims [1214](#) to [3440](#), wherein the decoding mode detector is configured to use the coloration sequence for determining the decoding mode indicator.

~~42. Channel decoder for channel decoding at least one transmitted code word, comprising:~~

~~a colorator for applying at least one coloration sequence to the at least one transmitted code word or to an error corrected at least one transmitted code word to obtain at least one colored code word;~~

~~wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, and~~

~~wherein the at least one coloration sequence is associated to a certain decoding mode as a specific coloration sequence;~~

~~a redundancy decoder for redundancy decoding the at least one colored code word to obtain a decoded output code word; and~~

~~a decoding mode detector for generating a decoding mode indicator indicating the certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word;~~

~~wherein the decoding mode indicator is associated to the at least one coloration sequence as the specific coloration sequence used for the coloration of the transmitted code word;~~

5 wherein the decoding mode detector is configured to store a candidate list indicating a predetermined number of candidate decoding modes, wherein one candidate decoding mode is indicated without any coloration sequence and the other respective candidate decoding modes are indicated in association with a coloration sequence, and to select one candidate decoding mode as a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word to be used,

10 wherein the decoding mode detector is configured to perform a first decoding mode operation and a second decoding mode operation,

15 wherein the decoding mode detector for performing the first decoding mode operation is configured to estimate the certain decoding mode being the candidate decoding mode without coloration sequence, to calculate syndromes of the code word, to check whether the calculated syndromes have value zero,

20 when the calculated syndromes have value zero, to calculate a hash value of the transmitted code word, to compare the calculated hash value and a hash value included in the transmitted code word, and

when the calculated hash value is equal to the included hash value, to generate the decoding mode indicator to indicate the candidate coding mode without coloration sequence as the certain decoding mode, or

25 when the calculated hash value is different from the included hash value, to exclude the candidate decoding mode without coloration sequence from the candidate list, and to proceed further with the second decoding mode operation.

30 36. Method for encoding a frame, comprising:

multi-mode redundancy encoding the frame in accordance with a certain coding mode from a set of different coding modes, wherein the coding modes are different from each other with respect to an amount of redundancy added to the frame.

35 outputting at least one code word;

applying a coloration sequence to the at least one code word; wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein a colorator is configured to select the specific coloration sequence in accordance with the certain coding mode, and

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splitting the frame into a plurality of data words, wherein the multi-mode redundancy encoder is configured to encode each of the plurality of data words according to the certain coding mode to obtain a plurality of code words,

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wherein the specific coloration sequence is applied to each code word in a predefined number of the code words or in a predefined subset of the plurality of code words.

~~43. Method for encoding a frame, comprising:~~

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~~redundancy encoding the frame in accordance with a certain coding mode from a set of different coding modes, wherein the coding modes are different from each other with respect to an amount of redundancy added to the frame,~~

~~outputting at least one code word; and~~

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~~applying a coloration sequence to the at least one code word; wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein the specific coloration sequence is selected in accordance with the certain coding mode.~~

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3744. Method according to claim 3643, comprising:

applying the certain coding mode in a previous frame, the first coding mode having associated therewith the coloration sequence,

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receiving, for a current frame, an indication to use a second encoding mode having associated therewith a further coloration sequence, and

applying the further coloration sequence in the current frame, or bypassing to apply any coloration sequence in the current frame.

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~~45. Method for encoding a frame, comprising:~~

~~multi-mode redundancy encoding the frame in accordance with a certain coding mode from a set of different coding modes, wherein the coding modes are different from each other with respect to an amount of redundancy added to the frame,~~

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~~outputting at least one code word;~~

~~applying a coloration sequence to the at least one code word; wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein a colorator is configured to select the specific coloration sequence in accordance with the certain coding mode, and~~

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~~splitting the frame into a plurality of data words, wherein the multi-mode redundancy encoder is configured to encode each of the plurality of data words according to the certain coding mode to obtain a plurality of code words,~~

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~~wherein the specific coloration sequence is applied to each code word in a predefined number of the code words or in a predefined subset of the plurality of code words.~~

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38. Method for channel decoding at least one transmitted code word, comprising:

applying at least one coloration sequence to the at least one transmitted code word to obtain at least one colored code word, wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence,

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wherein the at least one coloration sequence is associated to a certain decoding mode,

redundancy decoding the at least one colored code word to obtain a decoded output code word,

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generating a decoding mode indicator indicating a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word, wherein the decoding mode indicator is associated to the at least one coloration sequence used for the coloration of the colored code word,

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using, in addition to the coloration sequence, at least a further coloration sequence, or bypassing a colorator in a further decoding mode without any coloration;

5 redundancy decoding an additional at least one colored code word colored using the further coloration sequence, to obtain a further decoded code word, the further colored code word which obtained from the transmitted code word using the further coloration sequence, or the transmission code word without coloration to obtain an even further decoded code word,

10 outputting a reliability measure for the decoded code word, a further reliability measure for the further decoded code word or an even further reliability measure for the even further code word,

determining the decoding mode indicator based on the reliability measures, and

15 outputting as the decoded output code word, either the decoded code word, the further decoded code word, or the even further decoded code word based on the reliability measure,

20 wherein performing the coloration operation with the same coloration sequence to a predetermined number of the transmitted code words to obtain a predetermined number of the colored code words, and performing the further coloration operation with the same further coloration sequence to a further predetermined number of the transmitted code words to obtain a predetermined number of the further colored code words,

25 wherein determining the reliability measure deriving the predetermined number of the decoded code word, the further reliability measure deriving the predetermined number of the further decoded code word, or the even further reliability measure deriving the predetermined number of the decoded code word.

46. Method for channel decoding at least one transmitted code word, comprising:

30 applying at least one coloration sequence to the at least one transmitted code word to obtain at least one colored code word, wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein the at least one coloration sequence is associated to a certain decoding mode,

35 redundancy decoding the at least one colored code word to obtain a decoded output code word, and

generating a decoding mode indicator indicating a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word, wherein the decoding mode indicator is associated to the at least one coloration sequence used for the coloration of the colored code word.

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47. Method according to claim 46, comprising:

using, in addition to the coloration sequence, at least a further coloration sequence, or wherein the channel decoder is configured to bypass the colorator in a further decoding mode without any coloration;

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redundancy decoding an additional at least one colored code word colored using the further coloration sequence, to obtain a further decoded code word, the further colored code word which obtained from the transmitted code word using the further coloration sequence, or the transmission code word without coloration to obtain an even further decoded code word,

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outputting a reliability measure for the decoded code word, a further reliability measure for the further decoded code word or an even further reliability measure for the even further code word,

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determining the decoding mode indicator based on the reliability measures, and

outputting as the decoded output code word, either the decoded code word, the further decoded code word, or the even further decoded code word based on the reliability measure.

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39. Method for channel decoding at least one transmitted code word, comprising:

applying at least one coloration sequence to the at least one transmitted code word to obtain at least one colored code word, wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein the at least one coloration sequence is associated to a certain decoding mode,

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redundancy decoding the at least one colored code word to obtain a decoded output code word,

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generating a decoding mode indicator indicating a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word, wherein the decoding mode indicator is associated to the at least one coloration sequence used for the coloration of the colored code word.

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storing a candidate list indicating a predetermined number of candidate decoding modes, wherein one candidate decoding mode is indicated without any coloration sequence and the other respective candidate decoding modes are indicated in association with a coloration sequence, and to select one candidate decoding mode as a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word to be used.

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wherein determining process comprises a first decoding mode operation and a second decoding mode operation, wherein

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a first decoding mode operation comprises:

estimating the certain decoding mode being the candidate decoding mode without coloration sequence, calculating syndromes of the code word, checking whether the calculated syndromes have value zero, and when the calculated syndromes have value zero, calculating a hash value of the transmitted code word, comparing the calculated hash value and a hash value included in the transmitted code word.

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wherein the determining process comprises:

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receiving a result of the comparison between the calculated hash value and the included hash value.

when the calculated hash value is equal to the included hash value, generating the decoding mode indicator to indicate the candidate coding mode without coloration sequence as the certain decoding mode, or

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when the calculated hash value is different from the included hash value, excluding the candidate decoding mode without coloration sequence from the candidate list, and to proceed further with the second decoding mode operation.

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48. Method according to claim 46, comprising:

storing a candidate list indicating a predetermined number of candidate decoding modes, wherein one candidate decoding mode is indicated without any coloration sequence and the other respective candidate decoding modes are indicated in association with a coloration sequence, and to select one candidate decoding mode as a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word to be used,

wherein determining process comprises a first decoding mode operation and a second decoding mode operation, wherein

a first decoding mode operation comprises:

estimating the certain decoding mode being the candidate decoding mode without coloration sequence, calculating syndromes of the code word, checking whether the calculated syndromes have value zero, and when the calculated syndromes have value zero, calculating a hash value of the transmitted code word, comparing the calculated hash value and a hash value included in the transmitted code word,

wherein the determining process comprises:

receiving a result of the comparison between the calculated hash value and the included hash value,

when the calculated hash value is equal to the included hash value, generating the decoding mode indicator to indicate the candidate coding mode without coloration sequence as the certain decoding mode, or

when the calculated hash value is different from the included hash value, excluding the candidate decoding mode without coloration sequence from the candidate list, and to proceed further with the second decoding mode operation.

4049. Method according to claim 3948, wherein the second decoding mode operation comprises:

calculating a syndrome for the at least one transmitted code word,

applying a coloration sequence in association with the candidate decoding modes on the candidate list to obtain colored syndromes,

- 5 wherein ~~the syndrome colorator is configured to~~ applying the colorator sequence association with every candidate decoding mode on the candidate list to the syndrome, and

testing whether colored syndromes have value zero to obtain a result of the syndrome check,

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wherein the determining process comprises:

generating the decoding mode indicator based on the result of the syndrome check.

- 15 ~~50. Method for channel decoding at least one transmitted code word, comprising:~~

~~applying at least one coloration sequence to the at least one transmitted code word to obtain at least one colored code word, wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein the at least one coloration sequence is associated to a certain decoding mode,~~

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~~redundancy decoding the at least one colored code word to obtain a decoded output code word,~~

- 25 ~~generating a decoding mode indicator indicating a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word, wherein the decoding mode indicator is associated to the at least one coloration sequence used for the coloration of the colored code word,~~

- 30 ~~using, in addition to the coloration sequence, at least a further coloration sequence, or wherein the channel decoder is configured to bypass the colorator in a further decoding mode without any coloration;~~

- 35 ~~redundancy decoding an additional at least one colored code word colored using the further coloration sequence, to obtain a further decoded code word, the further colored code word~~

~~which obtained from the transmitted code word using the further coloration sequence, or the transmission code word without coloration to obtain an even further decoded code word;~~

~~outputting a reliability measure for the decoded code word, a further reliability measure for the further decoded code word or an even further reliability measure for the even further code word;~~

~~determining the decoding mode indicator based on the reliability measures, and~~

~~outputting as the decoded output code word, either the decoded code word, the further decoded code word, or the even further decoded code word based on the reliability measure.~~

~~51. Method for channel decoding at least one transmitted code word, comprising:~~

~~applying at least one coloration sequence to the at least one transmitted code word to obtain at least one colored code word, wherein the coloration sequence is such that at least one bit of the code word is changed by the application of the at least one coloration sequence, wherein the at least one coloration sequence is associated to a certain decoding mode,~~

~~redundancy decoding the at least one colored code word to obtain a decoded output code word;~~

~~generating a decoding mode indicator indicating a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word, wherein the decoding mode indicator is associated to the at least one coloration sequence used for the coloration of the colored code word;~~

~~storing a candidate list indicating a predetermined number of candidate decoding modes, wherein one candidate decoding mode is indicated without any coloration sequence and the other respective candidate decoding modes are indicated in association with a coloration sequence, and to select one candidate decoding mode as a certain decoding mode to be used by the redundancy decoder to obtain the decoded output code word to be used;~~

~~wherein determining process comprises a first decoding mode operation and a second decoding mode operation, wherein~~

~~a first decoding mode operation comprises:~~

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~~estimating the certain decoding mode being the candidate decoding mode without coloration sequence, calculating syndromes of the code word, checking whether the calculated syndromes have value zero, and when the calculated syndromes have value zero, calculating a hash value of the transmitted code word, comparing the calculated hash value and a hash value included in the transmitted code word,~~

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~~wherein the determining process comprises:~~

~~receiving a result of the comparison between the calculated hash value and the included hash value,~~

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~~when the calculated hash value is equal to the included hash value, generating the decoding mode indicator to indicate the candidate coding mode without coloration sequence as the certain decoding mode, or~~

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~~when the calculated hash value is different from the included hash value, excluding the candidate decoding mode without coloration sequence from the candidate list, and to proceed further with the second decoding mode operation.~~

25 [4152](#). Computer program having a program code for performing, when running on computer, a method according to claims [3643](#) to [3951](#).

[4253](#). Data stream generated by a method according to claims [3643](#) to [5139](#).