

WHAT IS CLAIMED IS:

1. A method of video decoding performed in a video decoder, comprising:
  - receiving a syntax element from a bitstream of a coded video indicating that residual blocks of a current coding unit (CU) are processed with a color space conversion, the residual blocks of the current CU including a luma residual block, a first chroma residual block, and a second chroma residual block;
  - in response to receiving the syntax element indicating that the residual blocks of the current CU are processed with the color space conversion, selecting one of two options of color space conversion equations; and
  - applying an inverse color space conversion using the selected option of color space conversion equations to the residual blocks of the current CU to generate modified versions of the residual blocks of the current CU.
2. The method of claim 1, wherein the two options of color space conversion equations include:
  - a first option of color space conversion equations including:
 
$$\text{tmp} = \text{rY}[x][y] - (\text{rCb}[x][y] \gg 1),$$

$$\text{rY}[x][y] = \text{tmp} + \text{rCb}[x][y],$$

$$\text{rCb}[x][y] = \text{tmp} - (\text{rCr}[x][y] \gg 1), \text{ and}$$

$$\text{rCr}[x][y] = \text{rCb}[x][y] + \text{rCr}[x][y]; \text{ and}$$
  - a second option of color space conversion equations including:
 
$$\text{tmp} = \text{rY}[x][y] - \text{rCb}[x][y],$$

$$\text{rY}[x][y] = \text{rY}[x][y] + \text{rCb}[x][y],$$

$$\text{rCb}[x][y] = \text{tmp} - \text{rCr}[x][y], \text{ and}$$

$$\text{rCr}[x][y] = \text{tmp} + \text{rCr}[x][y],$$
 wherein inputs to each option of color space conversion equations include:
  - an array of luma residual samples of the luma residual block with elements  $\text{rY}[x][y]$ ,
  - an array of chroma residual samples of the first chroma residual block with elements  $\text{rCb}[x][y]$ , and
  - an array of chroma residual samples of the second chroma residual block with elements  $\text{rCb}[x][y]$ ; and

outputs from each option of color space conversion equations include:

- a modified array of luma residual samples of the luma residual block with elements  $rY[x][y]$ ,
- a modified array of chroma residual samples of the first chroma residual block with elements  $rCb[x][y]$ , and
- a modified array of chroma residual samples of the second chroma residual block with elements  $rCb[x][y]$ .

3. The method of claim 2, wherein the selecting one of two options of color space conversion equations includes:

selecting the first option of color space conversion equations when a transform skip flag corresponding to each of the residual blocks of the current CU has a value of 1.

4. The method of claim 2, wherein the selecting one of two options of color space conversion equations includes:

selecting the second option of color space conversion equations when at least one of transform skip flags corresponding to the residual blocks of the current CU has a value of 0.

5. The method of claim 2, wherein the selecting one of two options of color space conversion equations includes:

selecting the first option of color space conversion equations when a transform skip flag corresponding to each of the residual blocks of the current has a value of 1 and a quantization parameter (QP) corresponding to each of the residual blocks of the current CU has a value of 4.

6. The method of claim 2, wherein the selecting one of two options of color space conversion equations includes:

selecting the second option of color space conversion equations when at least one of QPs corresponding to the residual blocks of the current CU has a value not equal to 4.

7. The method of claim 2, further comprising:

receiving a syntax element indicating only the first option of color space conversion equations is applied, the syntax element is one of a slice level syntax element, a picture level syntax element, or a sequence level syntax element.

8. The method of claim 2, further comprising:

receiving a syntax element indicating only the first option of color space conversion equations is applied regardless of a value of a flag indicating whether transform and quantization are bypassed for residuals of a CU, the syntax element is one of a slice level syntax element, a picture level syntax element, or a sequence level syntax element.

9. The method of claim 1, wherein the selecting one of two options of color space conversion equations includes:

selecting one of two options of color space conversion equations according to a value of a transform skip flag corresponding to each of the residual blocks of the current CU.

10. The method of claim 1, wherein the selecting one of two options of color space conversion equations includes:

selecting one of two options of color space conversion equations according to a variable indicating whether a block-based differential pulse code modulation (BDPCM) is applied to the current CU.

11. The method of claim 1, further comprising:

determining no color space conversion is applied to residual blocks of a CU when a bit depth of luma samples of the CU is different from a bit depth of chroma samples of the CU.

12. The method of claim 1, further comprising:

determining no color space conversion is applied to residual blocks of a CU when a bit depth of luma samples of the CU is different from a bit depth of chroma samples of the CU, and a transform skip flag corresponding to each of residual blocks of the CU has a value of 1 or 0.

13. The method of claim 1, further comprising:

determining no color space conversion is applied to residual blocks of a CU when a bit depth of luma samples of the CU is different from a bit depth of chroma samples of the CU, a QP corresponding to each of residual blocks of the CU has a value of 4, and a transform skip flag corresponding to each of the residual blocks of the CU has a value of 1 or 0.

14. An apparatus of video decoding, comprising circuitry configured to:

receive a syntax element from a bitstream of a coded video indicating that residual blocks of a current coding unit (CU) are processed with a color space conversion, the residual blocks of the current CU including a luma residual block, a first chroma residual block, and a second chroma residual block;

in response to receiving the syntax element indicating that the residual blocks of the current CU are processed with the color space conversion, select one of two options of color space conversion equations; and

apply an inverse color space conversion using the selected option of color space conversion equations to the residual blocks of the current CU to generate modified versions of the residual blocks of the current CU.

15. The apparatus of claim 14, wherein the two options of color space conversion equations include:

a first option of color space conversion equations including:

$$\begin{aligned} \text{tmp} &= rY[x][y] - (rCb[x][y] \gg 1), \\ rY[x][y] &= \text{tmp} + rCb[x][y], \\ rCb[x][y] &= \text{tmp} - (rCr[x][y] \gg 1), \text{ and} \\ rCr[x][y] &= rCb[x][y] + rCr[x][y]; \text{ and} \end{aligned}$$

a second option of color space conversion equations including:

$$\begin{aligned} \text{tmp} &= rY[x][y] - rCb[x][y], \\ rY[x][y] &= rY[x][y] + rCb[x][y], \\ rCb[x][y] &= \text{tmp} - rCr[x][y], \text{ and} \\ rCr[x][y] &= \text{tmp} + rCr[x][y], \end{aligned}$$

wherein inputs to each option of color space conversion equations include:

an array of luma residual samples of the luma residual block with elements  $rY[x][y]$ .

an array of chroma residual samples of the first chroma residual block with elements  $rCb[x][y]$ , and

an array of chroma residual samples of the second chroma residual block with elements  $rCb[x][y]$ ; and

outputs from each option of color space conversion equations include:

a modified array of luma residual samples of the luma residual block with elements  $rY[x][y]$ ,

a modified array of chroma residual samples of the first chroma residual block with elements  $rCb[x][y]$ , and

a modified array of chroma residual samples of the second chroma residual block with elements  $rCb[x][y]$ .

16. The apparatus of claim 15, wherein the circuitry is further configured to:
- select the first option of color space conversion equations when a transform skip flag corresponding to each of the residual blocks of the current CU has a value of 1.
17. The apparatus of claim 15, wherein the circuitry is further configured to:
- select the second option of color space conversion equations when at least one of transform skip flags corresponding to the residual blocks of the current CU has a value of 0.
18. The apparatus of claim 15, wherein the circuitry is further configured to:
- select the first option of color space conversion equations when a transform skip flag corresponding to each of the residual blocks of the current has a value of 1 and a quantization parameter (QP) corresponding to each of the residual blocks of the current CU has a value of 4.
19. The apparatus of claim 15, wherein the circuitry is further configured to:
- select the second option of color space conversion equations when at least one of QPs corresponding to the residual blocks of the current CU has a value not equal to 4.
20. A non-transitory computer-readable medium storing instructions that, when executed by a processor, cause the processor to perform a method of video decoding, the method comprising:

receiving a syntax element from a bitstream of a coded video indicating that residual blocks of a current coding unit (CU) are processed with a color space conversion, the residual blocks of the current CU including a luma residual block, a first chroma residual block, and a second chroma residual block;

in response to receiving the syntax element indicating that the residual blocks of the current CU are processed with the color space conversion, selecting one of two options of color space conversion equations; and

applying an inverse color space conversion using the selected option of color space conversion equations to the residual blocks of the current CU to generate modified versions of the residual blocks of the current CU.