Template based Rice parameter derivation (JVET-M0558)

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Introduction

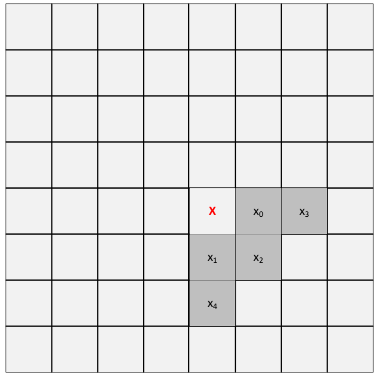
- In VTM 3.0 coefficient coding ***abs_remainder*** and ***dec_abs_level*** syntax element use Golomb Rice/exp Golomb codes
- The Rice parameter derivation for ***abs_remainder*** is HEVC like where the Rice parameter depends on the last coded value of last ***abs_remainder*** and the last Rice parameter

  cRiceParam = min(lastRiceParam + ((lastAbsRemainder > (3 * (1 << lastRiceParam))) ? 1 : 0), 3)

- The Rice parameter derivation and for ***dec_abs_level*** syntax element use local 5 neighbor template absolute sum based Rice parameter derivation

  cRiceParam = g_auiGoRiceParsCoeff [min(localAbsSum,31)]

  g_auiGoRiceParsCoeff[32] = {0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3}



localAbsSum= $\sum|x_i|$

Proposal

- Unify the Rice parameter derivation for coding of ***abs_remainder*** and ***dec_abs_level*** syntax elements by replacing the HEVC like Rice parameter derivation method used for coding of abs_remainder with the local neighbour template based method used in coding of ***dec_abs_level*** syntax element
- Use sum of absolute level values in local neighbor template to determine the Rice parameter for coding of ***abs_remainder*** syntax using the LUT used in for Rice parameter determination in coding pass for coding of ***dec_abs_level*** syntax element
- ***abs_remainder*** syntax represents half of remaining coefficient value, resulting look-up Rice parameter decremented by 1

  cRiceParam2 = g_auiGoRiceParsCoeff[min(localAbsSum, 31)]
  cRiceParam = Max(0, cRiceParam2 – 1)

- Alternatively, use VTM-2 look up table for Rice parameter derivation

  riceParTableVTM2[32]={0,0,0,0,0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,1,1,1,1,1,2,2,2,2,2,2,2,2}

  cRiceParam = g_auiGoRiceParsCoeff[min(localAbsSum, 31)]

Results

	All Intra Main10 Over VTM 3.0					Random access Main10 Over VTM 3.0					Low delay B Main10 Over VTM 3.0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	0.00%	0.00%	0.02%	101%	102%	-0.01%	0.07%	0.04%	101%	575%					
Class A2	0.02%	0.03%	0.05%	101%	101%	0.01%	0.16%	0.13%	101%	644%					
Class B	0.01%	0.03%	-0.03%	102%	102%	0.00%	0.18%	0.04%	80%	425%	0.01%	-0.38%	-0.35%	83%	272%
Class C	0.01%	-0.08%	-0.04%	101%	101%	-0.03%	-0.05%	0.09%	79%	811%	0.01%	0.13%	0.30%	83%	545%
Class E	-0.02%	0.02%	0.02%	101%	101%						0.01%	0.90%	-0.22%	84%	683%
Overall	**0.00%**	**0.00%**	**0.00%**	**101%**	**102%**	**-0.01%**	**0.09%**	**0.07%**	**88%**	**583%**	**0.01%**	**0.11%**	**-0.10%**	**83%**	**432%**
Class D	0.01%	0.11%	-0.06%	101%	101%	-0.02%	-0.31%	-0.08%	80%	932%	-0.03%	-0.75%	0.49%	84%	649%
Class F	0.04%	0.15%	0.20%	102%	101%	0.02%	0.08%	-0.01%	74%	366%	-0.02%	-0.14%	-0.35%	83%	310%

Relative run times not accurate

Alternative (VTM-2 Table) result

	All Intra Main10					Random access Main10					Low delay B Main10				
	Over VTM 3.0					Over VTM 3.0					Over VTM 3.0				
	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT	Y	U	V	EncT	DecT
Class A1	0.01%	-0.05%	0.00%	97%	102%	-0.01%	0.01%	0.11%	100%	575%					
Class A2	0.04%	0.03%	0.03%	99%	101%	0.02%	0.00%	0.26%	101%	644%					
Class B	0.03%	0.01%	0.00%	81%	102%	0.00%	0.07%	-0.09%	80%	425%	0.02%	-0.15%	-0.13%	83%	272%
Class C	0.02%	-0.04%	-0.03%	85%	101%	0.00%	-0.22%	0.19%	81%	811%	-0.01%	0.14%	0.20%	83%	545%
Class E	0.00%	0.02%	0.02%	84%	101%						0.16%	0.42%	-0.11%	83%	683%
Overall	**0.02%**	**-0.01%**	**0.00%**	**88%**	**102%**	**0.00%**	**-0.03%**	**0.09%**	**88%**	**583%**	**0.04%**	**0.09%**	**-0.02%**	**83%**	**432%**
Class D	0.02%	0.03%	0.06%	86%	101%	0.00%	-0.24%	-0.13%	79%	932%	0.06%	-0.08%	-0.25%	84%	649%
Class F	0.07%	0.14%	0.10%	86%	101%	0.02%	0.13%	0.04%	74%	366%	0.19%	-0.09%	0.34%	84%	310%

Relative run times not accurate

Conclusion

- Unify Rice parameter derivation for coding of ***abs_remainder*** and ***dec_abs_level*** syntax elements by using the local template based scheme of ***dec_abs_level*** for ***abs_remainder*** coding.
- Propose to adopt one of the proposed methods in VTM

- Thanks Samsung for crosschecking