

Non-EE2: Low-delay configurations for LFNST/NSPT (JVET-AH0103)

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Motivation

- In ECM-12.0 CTC, LFNST/NSPT is disabled for low-delay configurations.
 - High potential coding gain ($> 1.5\%$), but also high complexity ($\sim 113\%$ EncT)
 - Need to find attractive gain/complexity trade-offs
- Encoding times and coding performance trade-off for both intra- and inter-LFNST/NSPT in LDB.
 - When intra-LFNST/NSPT is enabled,
0.7% gain with 110% EncT, relative to CTC (Disabling LFNST/NSPT)
 - When inter-LFNST/NSPT is enabled on top of intra-LFNST/NSPT,
0.87% gain with 103.8% EncT*

* F. Wang, J. Gan, Y. Yu, H. Yu, and D. Wang, “EE2-3.3: Utilizing LFNST/NSPT for inter coding”, JVET-AG0061, Jan. 2024.

Proposed configurations for low-delay

- Complexity analysis of intra-LFNST/NSPT for LD (total 110% EncT)
 - 9% EncT comes from applying for P/B slice
 - 1% EncT comes from applying for I slice
 - Coding performance impact from each of P/B and I slices is similar
 - Disabling intra-LFNST/NSPT in P/B-slices could lead a better trade-off.
- Early termination for faster encoding of inter-LFNST/NSPT
 - Existing algorithm: Early Termination(ET) with block size-adaptive threshold for cost ratio
 - Apply the smaller threshold value to have more ET, bringing more speed-up.
- The proposed configurations for low-delay

	Intra-LFNST/NSPT		Inter-LFNST/NSPT with fast encoder
	Enabled in I-slice	Enabled in P/B slice	
Test A	O	X	O
Test B	X	X	O

Experimental results – Test A

- The following options are added to encoder_lowdelay_ecm.cfg and encoder_lowdelay_P_ecm.cfg

IntraLFNSTISlice	: 1
IntraLFNSTPBSlice	: 0
InterLFNST	: 1
FastInterLFNST	: 1

	Low delay B Main10				
	Over ECM-12.0 CTC				
	Y	U	V	EncT	DecT
Class B	-0.85%	-0.32%	-0.43%	101.2%	100.9%
Class C	-1.54%	-0.54%	-0.17%	102.0%	102.1%
Class E	-1.14%	0.08%	-1.37%	102.0%	102.1%
Overall	-1.15%	-0.29%	-0.58%	101.7%	101.6%
Class D	-0.91%	0.41%	-0.20%	102.2%	102.6%
Class F	-1.25%	0.11%	-0.33%	101.5%	102.9%

	Low delay P Main10				
	Over ECM-12.0 CTC				
	Y	U	V	EncT	DecT
Class B	-0.97%	-0.29%	-0.35%	101.7%	100.8%
Class C	-1.50%	-0.36%	0.06%	101.9%	102.0%
Class E	-1.34%	-0.28%	-0.78%	102.3%	101.9%
Overall	-1.24%	-0.31%	-0.32%	101.9%	101.5%
Class D	-1.16%	-1.03%	-0.06%	102.0%	101.1%
Class F	-1.28%	0.21%	0.17%	101.6%	100.1%

Experimental results – Test B

- The following options are added to encoder_lowdelay_ecm.cfg and encoder_lowdelay_P_ecm.cfg

IntraLFNSTISlice	: 0
IntraLFNSTPBSlice	: 0
InterLFNST	: 1
FastInterLFNST	: 1

	Low delay B Main10				
	Over ECM-12.0 CTC				
	Y	U	V	EncT	DecT
Class B	-0.74%	0.28%	0.41%	100.9%	100.7%
Class C	-0.84%	0.07%	0.23%	101.5%	102.2%
Class E	-0.72%	0.14%	-0.81%	101.4%	102.1%
Overall	-0.77%	0.17%	0.04%	101.2%	101.6%
Class D	-0.78%	0.66%	0.16%	101.3%	102.8%
Class F	-0.32%	-0.07%	-1.13%	101.1%	100.7%

	Low delay P Main10				
	Over ECM-12.0 CTC				
	Y	U	V	EncT	DecT
Class B	-0.83%	0.20%	0.46%	101.6%	101.0%
Class C	-1.02%	0.17%	0.21%	101.5%	101.7%
Class E	-1.08%	0.00%	-0.02%	101.7%	102.7%
Overall	-0.95%	0.14%	0.25%	101.6%	101.7%
Class D	-0.96%	-0.48%	0.56%	101.7%	101.4%
Class F	-0.55%	0.13%	0.60%	101.1%	100.5%

Conclusion

- Two LFNST/NSPT configurations for LD are proposed: Test A/B
 - Intra-LFNST/NSPT is applied to only I-slice (Test A), or totally disabled (Test B).
 - Faster encoding for inter-LFNST/NSPT is employed with smaller threshold (Test A/B).
- Significant coding gains even with relatively small EncT increase.
 - Test A: LDB -1.15% with 101.7% EncT / LDP -1.24% with 101.9% EncT
 - Test B: LDB -0.77% with 101.2% EncT / LDP -0.95% with 101.6% EncT
- It is recommended to adopt one of the proposed configurations in next ECM.

Thanks to Qualcomm and OPPO for the crosschecking!