

Non-EE2: On large NSPT (JVET-AD0187)

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Summary of NSPT in ECM-8.0

- In the 29th JMET meeting, Non-Separable Primary Transform (NSPT) was adopted.
 - Applied for specific block sizes (4x4, 4x8/8x4, 4x16/16x4, 8x8, and 8x16/16x8) instead of LFNST + DCT-II, for intra coding
 - Same kernel mapping for intra mode as in LFNST
 - NSPT matrix dimension

Type	Dimension
NSPT4x4	16x16
NSPT4x8/NSPT8x4	32x20
NSPT8x8	64x32
NSPT4x16/NSPT16x4	64x24
NSPT8x16/NSPT16x8	128x40

- Coefficients generated by forward NSPT are placed in scan order, and the other positions are zeroed out.

Proposed large NSPT

- Large NSPT for $N \times 32 / 32 \times N$ ($N = 4$ and 8) blocks is proposed.
 - As in ECM-8.0, LFNST+DCT-II is replaced by NSPT for the $N \times 32 / 32 \times N$ blocks.
 - The number of transform sets and kernels per set are not changed for the proposed large NSPT (i.e. 35 and 3 each).
 - 36×128 and 48×256 matrices for $4 \times 32 / 32 \times 4$ and $8 \times 32 / 32 \times 8$ blocks, respectively
 - The existing NSPT kernels in ECM-8.0 are unchanged.
- Zeroing-out of coefficients other than first 36 and 48 ones in scan order, for $4 \times 32 / 32 \times 4$ and $8 \times 32 / 32 \times 8$, respectively
 - Similar as in ECM-8.0, an NSPT index is not signalled, when non-zero coefficients are detected in the zero-out region.

Experimental results

- 0.09% BD-rate reduction for AI, relative to ECM-8.0 anchor
 - More gains are observed in high resolution sequences.

	All Intra Main10				
	Over ECM-8.0 CTC				
	Y	U	V	EncT	DecT
Class A1	-0.09%	-0.02%	-0.12%	102%	101%
Class A2	-0.12%	-0.17%	-0.10%	102%	100%
Class B	-0.10%	-0.15%	-0.15%	102%	101%
Class C	-0.05%	-0.06%	-0.05%	101%	100%
Class E	-0.12%	-0.12%	-0.15%	101%	101%
Overall	-0.09%	-0.11%	-0.11%	102%	100%
Class D	-0.03%	-0.30%	-0.26%	101%	101%
Class F	0.03%	-0.06%	0.12%	101%	100%

Conclusion

- The large NSPT kernels for $N \times 32/32 \times N$ ($N = 4$ and 8) are proposed.
 - 0.09% coding gain with 102%/100% EncT/DecT
- It is recommended to further investigate the large NSPT in the next round of EE2.