JVET-K0265 - CE6-related: Reduction of the number of core transforms in AMT



11th JVET meeting, Ljubljana, SI, July 2018

Proposal overview

BMS design

- 4 additional transforms
  - DST1
  - DST7
  - DCT5
  - DCT8

Problems associated with the current design

- Increased complexity and/or memory requirement
- Fast transforms are not always available, and when available they are much slower than DCT2

➔ DCT5, DCT8 and DST7 are based on odd length DFT, for which the corresponding FFT is not easy to design

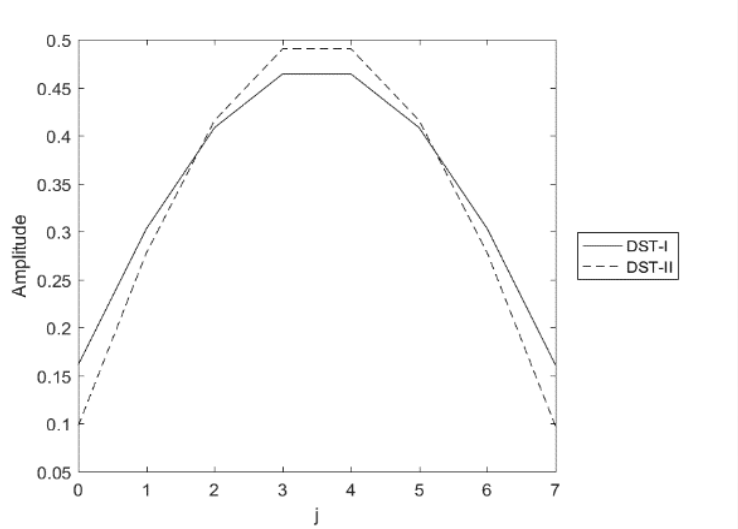
Goal: replace the BMS AMT transforms with others that can be inferred or inherited from DCT2

Approach: look at similarities between first basis functions of the current 4 transforms

Proposed changes

- Modif 1:
  - DST1 → DST2 (inferred from DCT2)
- Modif 2:
  - DCT5 → DCT2
- Modif 3:
  - DST7 → DST4 (inherited from DCT2)
  - DCT8 →DCT4 (inferred from DCT2)

High similarity between DST1 and DST2



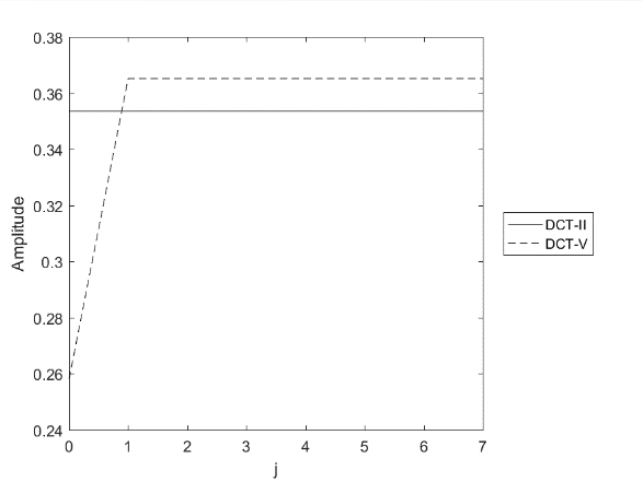
Anchor BMS 1.1, RA

	Y	U	V
Class A1	0.03%	0.06%	0.05%
Class A2	0.06%	0.26%	0.17%
Class B	0.02%	0.25%	-0.11%
Class C	-0.01%	0.05%	-0.04%
Class E			
Overall	**0.02%**	**0.16%**	**-0.01%**
Class D	-0.02%	0.30%	0.35%

DST2 can be inferred from DCT2, using sign changing and reverse ordering operation

- Same factorization for DCT2

High similarity between DCT5 and DCT2

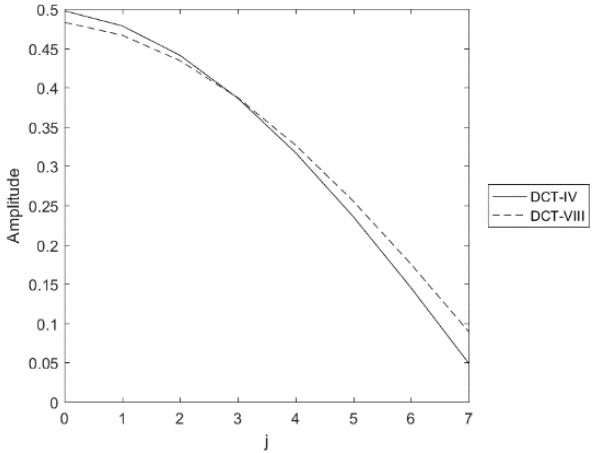


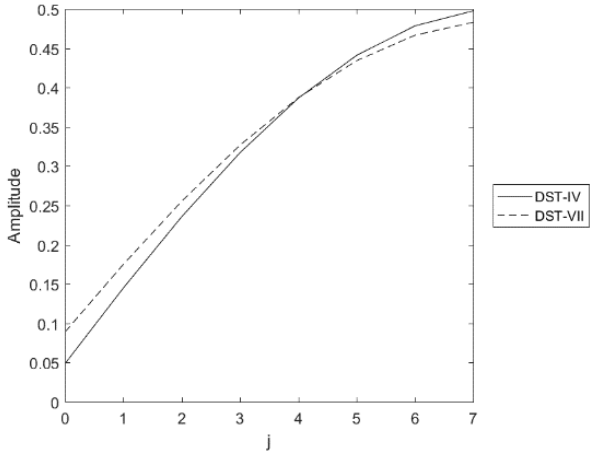
Anchor BMS 1.1, RA

	Y	U	V
Class A1	0.01%	0.17%	0.08%
Class A2	0.01%	0.13%	0.11%
Class B	0.03%	0.15%	0.04%
Class C	0.03%	0.31%	-0.18%
Class E			
Overall	**0.02%**	**0.19%**	**0.00%**
Class D	0.04%	-0.12%	-0.19%

In practice, DCT5 can be replaced by DCT2 for input length larger than 8

High similarity between DCT8 and DCT4, and also between DST7 and DCT4





Both can be inherited from DCT2

- See also K0264 (CE6.1.3)

Anchor BMS 1.1, RA

	Y	U	V
Class A1	0.23%	0.35%	0.22%
Class A2	0.25%	0.54%	0.19%
Class B	0.09%	0.05%	0.21%
Class C	-0.15%	-0.03%	-0.36%
Class E			
Overall	**0.09%**	**0.19%**	**0.06%**
Class D	-0.25%	-0.29%	-0.36%

Anchor BMS 1.1, RA

	Y	U	V
Class A1	0.26%	0.47%	0.43%
Class A2	0.36%	0.68%	0.34%
Class B	0.18%	0.47%	0.19%
Class C	-0.13%	0.13%	-0.29%
Class E			
Overall	**0.15%**	**0.42%**	**0.14%**
Class D	-0.18%	-0.16%	-0.48%

Conclusions

- This proposal provides some approximations of the BMS1.1 AMT transforms by others that can be inherited or inferred from DCT2
- Potential encoder/decoder speed up as many DCT2 fast algorithms exist, including the current partial butterfly implementation
- Reduced memory requirement
- Limited coding efficiency impact
  - Modif 1: DST1 → DST2 (inferred from DCT2)
  - Modif 2: DCT5 → DCT2 (for input length > 8)
  - Modif 3: DST7 → DST4 (built from DCT2) and DCT8 →DCT4 (inferred from DCT2)

	Y	U	V
Modif 1	**0.02%**	**0.16%**	**-0.01%**
Modif 2	**0.02%**	**0.19%**	**0.00%**
Modif 3	**0.09%**	**0.19%**	**0.06%**
Modif 1+2+3	**0.15%**	**0.42%**	**0.14%**