

DCT+Hadamard low complexity large transform for Inter coding (JCTVC-C255/m18296)

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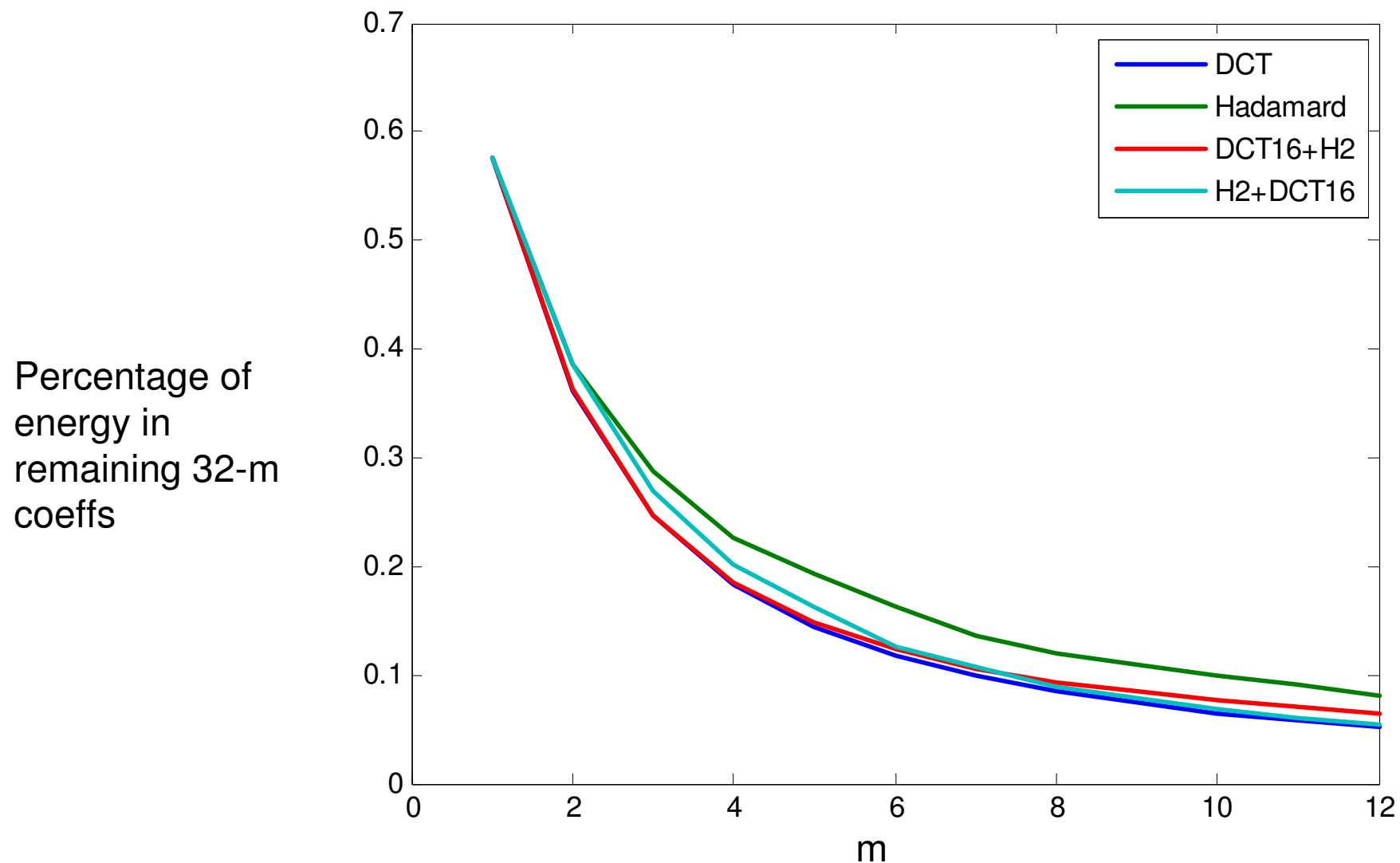
**** Texas Instruments India**

**Joint Collaborative Team on Video Coding (JCT-VC)
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Introduction

- In TMuC, large size DCTs 16x16, 32x32, 64x64 are supported
- Large size transforms provide coding gain but increase implementation complexity significantly
- Contribution proposes a class of transforms for large block sizes which is a combination of DCT+Hadamard transforms for reducing computational complexity of Inter transforms
- Following transforms were studied **when applied to Inter blocks only**
 - (Anchor: 64x64 is disabled for Intra and Inter)
 - DCT32
 - Hadamard32
 - DCT16+Hadamard2
 - Hadamard2+DCT16
 - DCT8+Hadamard4
 - Hadamard4+DCT8

Energy compaction properties (Theoretical results on Markov-1, $\rho=0.9$)

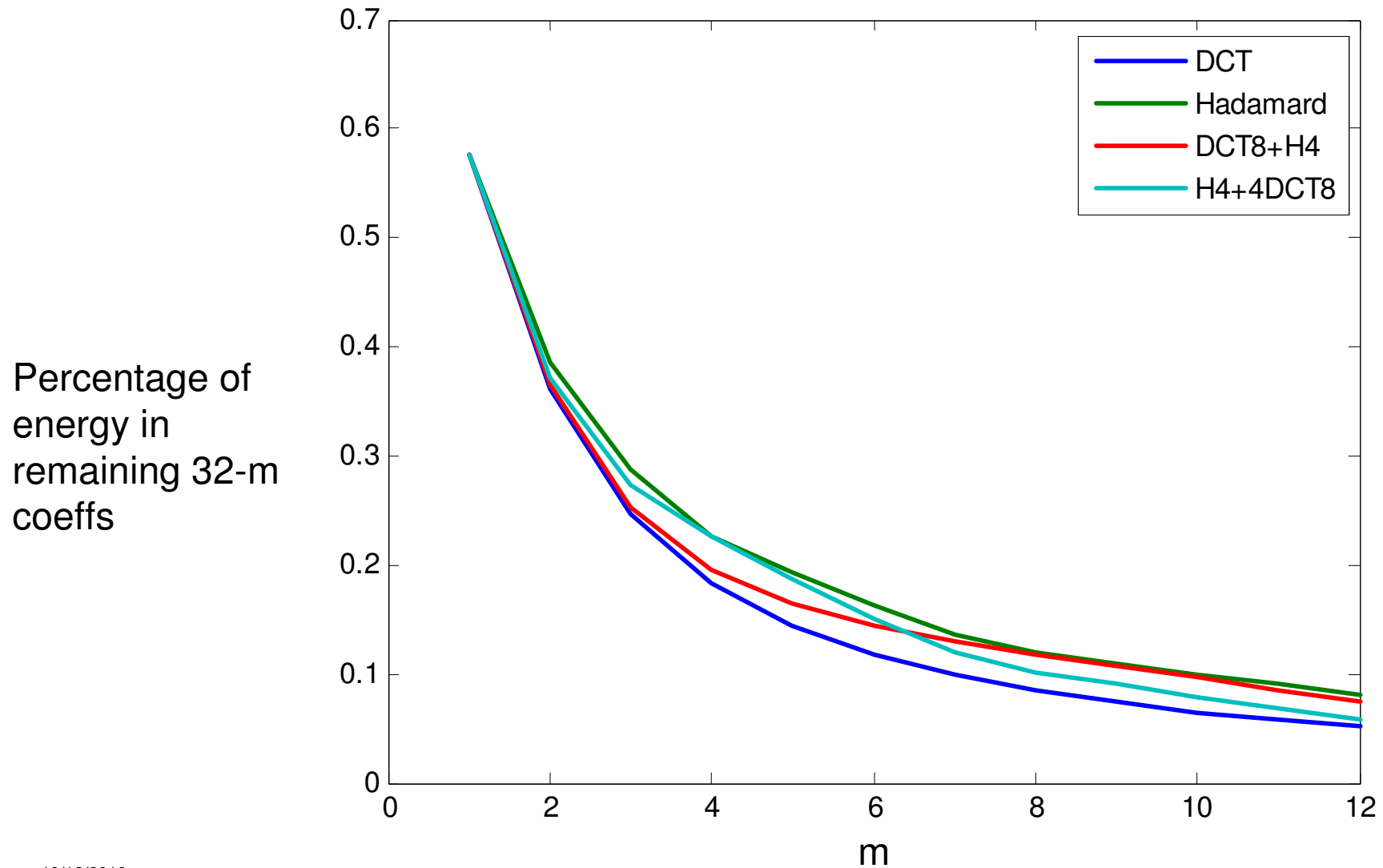


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JCTVC-C226

Energy compaction properties (Theoretical results on Markov-1, $\rho=0.9$)



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JCTVC-C226

Results on 65 frames

- Anchor is TMuC-0.7.3 without 64x64
- See JCTVC-C255-65frm.xls

Coding gains results for Random access for all frames

- DCT16+Hadamard2
- Anchor used is TE12-TUSize_maxTU32x32_minTU4x4-TI.xls

	Random access			Random access LoCo		
	Y BDR	U BDR	V BDR	Y BDR	U BDR	V BDR
Class A	0.1	-0.1	-0.1	8.3	7.6	7.3
Class B	0.4	-0.2	-0.2	10.5	8.7	7.8
Class C	0.1	0.1	-0.1	5.0	4.6	4.7
Class D	0.1	0.1	0.1	4.3	3.0	3.5
Class E						
All	0.2	0.0	-0.1	7.1	5.9	5.8

Coding gains results for Low delay for all frames

- DCT16+Hadamard2
- Anchor used is TE12-TUSize_maxTU32x32_minTU4x4-TI.xls

	Low delay			Low delay LoCo		
	Y BDR	U BDR	V BDR	Y BDR	U BDR	V BDR
Class A						
Class B	0.7	-0.2	-0.4	6.1	1.9	1.8
Class C	0.2	0.0	0.0	2.5	1.2	1.4
Class D	0.1	-0.1	-0.3	1.9	-0.4	0.2
Class E	0.5	0.8	-0.6	27.2	21.0	22.5
All	0.4	0.1	-0.3	8.1	4.7	5.2

Computational complexity savings

- DCT16+Hadamard2: Four 16x16 transforms instead of one 32x32 transform
- Number of multipliers (assuming Chen's DCT/IDCT)
 - DCT32 = 7424 multiplications
 - 4 DCT16 = $4 * 1408 = 5632$ multiplications
 - Savings of 24%
- Number of multipliers assuming matrix multiplication: Savings of 50%

Conclusions

- DCT+Hadamard transform appears to be a promising approach that can be considered for Low complexity configuration
- Zonal coding etc. can be used on top of these transforms
- Request core experiment be started on DCT+Hadamard transform