CCITT SG XV
Working Party XV/1
Specialists Group on Coding for Visual Telephony

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SOURCE : **TELECOM PARIS UNIVERSITY - FRANCE**

TITLE : **Performance of a new fast algorithm for 8*8 IDCT**

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1 - A NEW ALGORITHM

We propose a new DCT fast flow graph exhibiting exellent accuracy features and well suited for our architectural approach (*).

The outlines of this new fast flow graph are :

- An 8-points DCT requires only 11 multiplications and 29 additions. A16-points DCT requires only 31 multiplications and 81 additions. This is the minimum known for this algorithm, and perhaps the absolute minimum.
- This flow graph exhibits useful regularity and recursive properties.

The VLSI implementation of an 8*8 DCT chip based on this algorithm and our architecture leads to a 60000 transistor chip for a maximum throughput rate of 54MHz.

2 - ACCURACY PERFORMANCE RESULTS

We have done simulation according to the method proposed for the Meeting of DCT Chip Manufactures. We meet all parameters, exept the overall mean square error requirement of 2% : the proposed algorithm has a mean square error performance of 2.9%.

The results are the same when changing the sign on each pixel.

For L=H=500, there are less errors. This is normal because the clipping of the output to the range -256 to +255 when computing an IDCT make a lot of value equal to -256 or +255. There are no possible errors on these values.

(*) This architectural aproach was used to design the TV3200 Real Time Discret Cosine Transform Chip of SGS-THOMSON MICROELECTRONICS.

ANNEX 1

RESULTS OF SIMULATIONS

A : Simulation for 640000 random integer pixels in the range -256 to +255

Peak Error :	**1**
Number of error of 1 :	18307 (2.86%)
Peak Pixel Mean Square Error :	**0.042**
Overall Mean Square Error :	**0.029**
Peak Pixel Mean Error :	**0.013**
Overall Mean Error :	**0.005**

MEAN ERROR VERSUS PIXEL LOCATION (x 1000)

9	2	4	8	5	4	4	5
4	4	4	9	5	5	5	4
13	4	6	2	9	4	4	1
10	3	5	7	5	5	5	8
0	7	1	7	7	7	5	9
1	4	3	4	2	5	6	6
2	5	3	5	6	6	4	3
3	5	5	2	3	5	5	7

MEAN SQUARE ERROR VERSUS PIXEL LOCATION (x 1000)

18	20	23	25	26	20	18	16
21	26	28	28	26	26	25	24
29	26	32	33	35	30	31	26
35	36	39	37	40	36	36	36
33	35	38	37	42	41	38	37
25	34	33	31	35	29	29	27
21	24	28	31	30	28	24	23
16	20	22	23	26	24	20	19

B : Simulation for 256000 random integer pixels in the range -5 to +5

Peak Error :	**1**
Peak Pixel Mean Square Error :	**0.037**
Overall Mean Square Error :	**0.020**
Peak Pixel Mean Error :	**0.013**
Overall Mean Error :	**0.005**

C : Simulation for 256000 random integer pixels in the range -500 to +500

Peak Error :	**1**
Peak Pixel Mean Square Error :	**0.029**
Overall Mean Square Error :	**0.018**
Peak Pixel Mean Error :	**0.007**
Overall Mean Error :	**0.003**