CCITT SGXV
Specialists Group on Coding
for Visual Telephony

Document #380
Sept. 1988

Title: Results related to the Transformer specification

Source: CSELT

In the last period investigations were carried out at CSELT with the intention to see whether it would be possible to avoid the need of experimental tests for the specification of the transformer, at least for what concern the maximum error on a single pixel, and to evaluate this feature with a direct computation according to a rule built taking into account all the parameters which contribute to produce the possible "mismatch".

During the investigation it was immediately evident that, due to the non-linearity of quantisation, it would not be possible to avoid the mismatch (coincident inversions starting from a unique set of 2-D quantised coefficients) with any kind of specifications on the arithmetic.

What it was possible to do was to produce the specifications to solve the "reversibility" problem (direct and inverse transformation without errors), with coincident or different transform base matrices for the direct and inverse process.

The results, presented at the PCS'88, refer to the case of a generic transformation and also exploit the additional information coming from the use of the DCT: in this second case less pressing conditions for the base representation can be obtained.

Summarising, the following noticeable points have been obtained:
1 - using a specified arithmetic and the matrix multiplication it is possible to make the direct/inverse tranformation process errorless for identical or different transform base matrices;
2 - due to the quantisation of the coefficients (non linear process) it is not possible to avoid the mismatch but just limiting the peak error to 1 in magnitude and that is obtained by using the upper mentioned arithmetic;
3 - there is a mean to extend the validity of the results derived for the matrix multiplication to each fast algorithm envisaged;
4 - a procedure exists which directly compute the input configuration producing the maximum output error (on a single component) due to the lack of precision in the representation of the base values;
5 - it is assumed for the moment that the error due to the base and the other round-off errors, made applying the 1-D transform algorithm, could be added;
6 - based on points 3 and 5 a method can be derived of validating the transform chip(s) with respect to the first requirement (maximum absolute value).

Specification of such a method will be provided at the next meeting.