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**Core Experiment 13.21 on RAHT quantization**

# Abstract

This document provides a description of Core Experiment 13.21 on RAHT quantization and square root approximation.

# Introduction

The goal of Core Experiment 13.21 is to evaluate the harmonization between RAHT and Lifting proposed in [1], more specifically the behaviour of G-PCC Test Model regarding 1) potential overflow in the computation of the adjusted quantization step in TMC13v6 [2] and the computation of the adjusted coefficient proposed in [1]; and 2) the approximation of the square root operation used in the Test Model.

Overflow handling for adjusted coefficients was proposed in [1], but TMC13v6 does not have an equivalent procedure for its adjusted quantization step. Under certain conditions, overflow may directly affect the adjustment of the coefficients in [1] and the absence of an overflow handling procedure implicate major rate-distortion issues. In [2], overflow affects the adjustment of the quantization step and the effect of overflow is not evident in a rate-distortion sense.

In the context of [1], a problem with the current approximation of the square root was observed. Evidences show that for a specific range of low numbers, the error in relation to the *sqrt*(*)* function of the C/C++ math library can be significantly large. Preliminary experimentations show that adopting 4 iterations instead of 2 yields better results in [1].

# Mandates

The mandates for CE are as follows:

1. Perform a study on the bit depth needed to avoid overflow for a certain number of points.
   1. TMC13v6 (previous anchor using adjusted quantization step) – RAHT using a Lifting implementation
   2. TMC13v7 (anchor) – RAHT using a Butterfly implementation
   3. TMC13v7 + [1] (using adjusted coefficient) – RAHT using a Lifting implementation
2. Study the number of iterations for square root approximation versus bd-rate gains (based on TMC13v7).

# Participants

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(P=proponent, C=crosss checker)

# Evaluation method

* Overflow
  + A theoretical analysis will be performed.
* Square-root
  + BD-rate gains will be computed for different number of iterations.

## Test condition

* Proposals will be implemented on top of TMC13v7.0 [3].
* Test conditions will follow the CTC conditions [4].

# Timeline

* 2019-07-12 MPEG #127 meeting ends.
* 2019-07-26 Expected date for Release of finalized CE description.
* 2019-08-12 Expected date for Release of cross-verified TMC13v7 software and anchors.
* 2019-09-18 CE Software and results are released to cross-checkers.
* 2019-09-25 Preliminary feedback from cross-checkers.
* 2019-10-02 MPEG document upload deadline.
* 2019-10-07 MPEG #128 meeting starts.

# References

1. “[G-PCC] (New) Lifting and RAHT harmonization,” ISO/IEC JTC1/SC29 WG11 (MPEG) input document m48918, Gothenburg, SE, July 2019
2. “G-PCC TMC13v6”, ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. w18476, Geneva, Switzerland, March 2019.
3. “G-PCC Test Model 7”, ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. w18664, Goteborg, Sweden, July 2019
4. “Common Test Conditions for PCC” ISO/IEC JTC1/SC29 WG11 MPEG2019”, ISO/IEC JTC1/SC29/WG11 MPEG2019 Doc. w18665, Goteborg, Sweden, July 2019