



JCTVC-AM0023

Illustration of the film grain characteristics SEI message in HEVC

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Summary of contribution

- Description of a software implementation that illustrates the use of the film grain characteristics (FGC) SEI message in HEVC
- The software illustrates use of FGC SEI using the example of film grain synthesis specified in SMPTE RDD 5
- The example software also illustrates the methods of SMPTE RDD 5 applied to 10- and 12-bit content in 4:2:2 and 4:4:4 chroma format and HDR transfer characteristics.
- The software may be used to experiment with various use cases, such as:
 - Simulation of film grain for content from which original film grain was removed
 - Simulation of film grain for content that never had film grain
 - Masking of compression artefacts
 - Creating a subjective “look” for content

Illustration of FGC SEI message based on SMPTE RDD 5

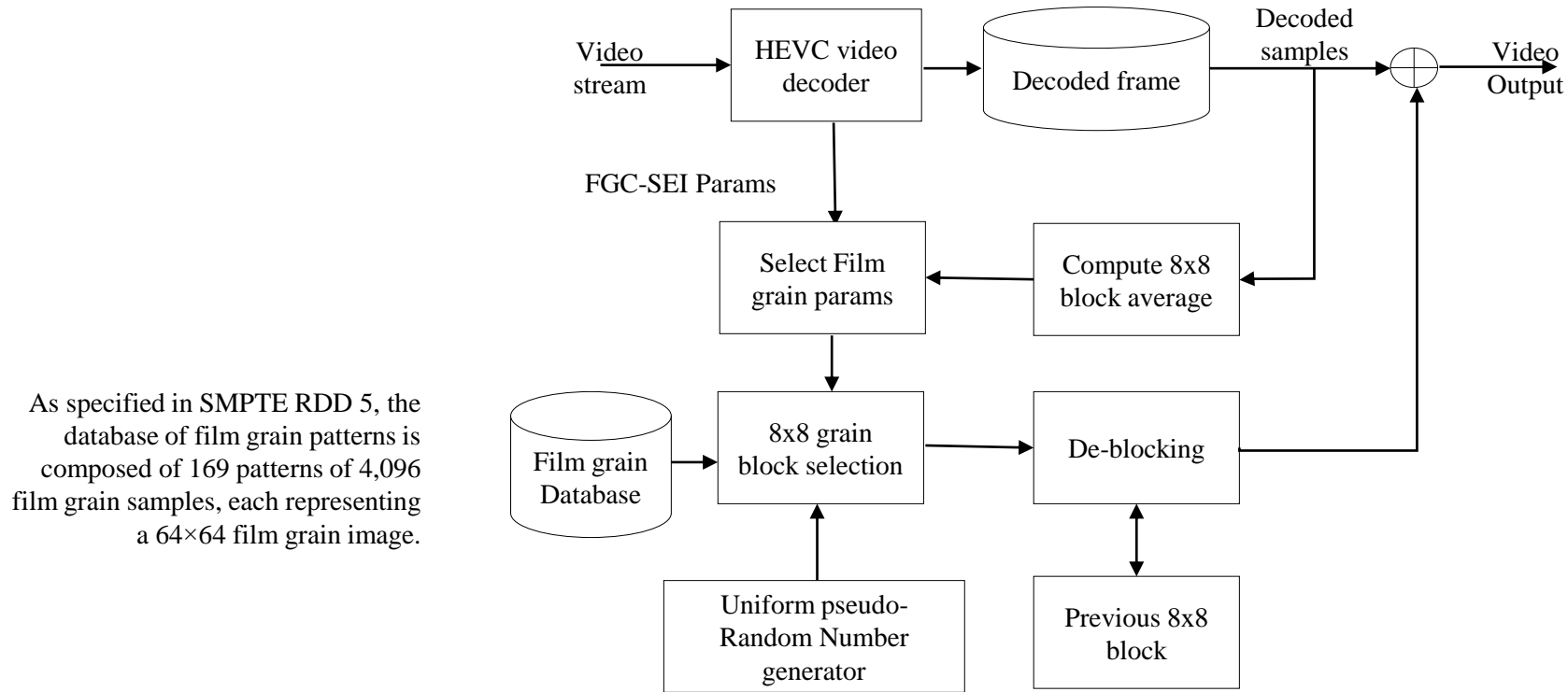


Figure 1 Film grain simulation and blending workflow for SMPTE RDD 5

SII SEI syntax, software package, and example settings

Table 1 Film grain characteristics SEI message syntax

film_grain_characteristics(payloadSize) {	Descriptor
film_grain_characteristics_cancel_flag	u(1)
if(!film_grain_characteristics_cancel_flag) {	
film_grain_model_id	u(2)
separate_colour_description_present_flag	u(1)
if(separate_colour_description_present_flag) {	
film_grain_bit_depth_luma_minus8	u(3)
film_grain_bit_depth_chroma_minus8	u(3)
film_grain_full_range_flag	u(1)
film_grain_colour_primaries	u(8)
film_grain_transfer_characteristics	u(8)
film_grain_matrix_coeffs	u(8)
}	
blending_mode_id	u(2)
log2_scale_factor	u(4)
for(c = 0; c < 3; c++)	
comp_model_present_flag[c]	u(1)
for(c = 0; c < 3; c++)	
if(comp_model_present_flag[c]) {	
num_intensity_intervals_minus1[c]	u(8)
num_model_values_minus1[c]	u(3)
for(i = 0; i <= num_intensity_intervals_minus1[c]; i++) {	
intensity_interval_lower_bound[c][i]	u(8)
intensity_interval_upper_bound[c][i]	u(8)
for(j = 0; j <= num_model_values_minus1[c]; j++)	
comp_model_value[c][i][j]	se(v)
}	
}	
film_grain_characteristics_persistence_flag	u(1)
}	
}	

The FGS software is under Macro: **FGS_RDD5_ENABLE**

film_grain_characteristics.cfg specifies the parameters for each component: num_intensity_intervals_minus1, num_model_values_minus1, intensity_interval_lower_bound, intensity_interval_higher_bound and comp_model_value.

The encoding command line is: TAppEncoder.exe -c encoder_randomaccess_main10.cfg -c input.cfg -c film_grain_characteristics.cfg

The decoding command line is: TAppDecoder.exe -b str.bin -o decoded.yuv --SEIFGSFilename=decoded_FGS.yuv

Table 2 FGC SEI syntax parameter values for SMPTE RDD 5

Parameter	Supported value / Range	Explanation
film_grain_model_id	0	Frequency filtering model
separate_colour_description_present_flag	0	Film grain colour space same as encoding colour space
blending_mode_id	0	Additive blending
log2_scale_factor	2-7	Ensures simulation compatible with 16-bit signed integer math
num_model_values_minus1[c]	0-2	Bandpass and cross-colour correlation not supported
comp_model_value[c][i][0]	0-(2 ^{Bitdepth} - 1)	See Note
comp_model_value[c][i][1]	2-14	Indicates horizontal cut-off frequency
comp_model_value[c][i][2]	2-14	Indicates vertical cut-off frequency
film_grain_characteristics_persistence_flag	0	FGC SEI message applied to the current decoded frame only

Note: SMPTE-RDD5 is specified for 8-bits but the example software implementation we provide extends RDD5 to higher bit depths, which allows comp_model_value[c][i][0] to exceed 255 for higher bit depths, with a maximum supported value of (2^{Bitdepth} - 1).

Simulations and crosscheck

- We ran simulations to verify the performance of the software and FGC SEI message function
- Verification test sequence: HEVC CTC clip ArenaOfValor 1080p 4:2:0 encoded Main 10
(ArenaOfValor is a gaming sequence so it is clean and easier to observe the effect of film grain simulation)
- 5 simulations:
 - 4 for luma only, 1 for luma and chroma
 - 3 luma simulations used settings to accentuate film grain for testing purposes beyond what would be sensible for a real use case
 - 1 luma simulation used settings more likely to be useful for a real use case
- It was observed that the example software implementation and FGC SEI message function as expected









18:05
33 vs 17
55.6k 45.7k
3 3 2



HM: QP 37
No film grain

7/3/8
38
13348

4/5/14
19
11381

7/3/8
14
10013

5/3/12
29
9262

10/3/9
11624

0/6/7
7265

9/11/1
9988

1/5/4
8084

1/6/7
8228

6/5/2
11624

拥你入怀cc
15

抱你入梦cc
15

151
上荣耀必表白
15

509 152
80 42
138

775
283
800

+34g
39g

11 1X + 18:05 / 21:30 弹幕





3 6 55.6k 33 vs 17 45.7k 3 2

HM: QP 37
Luma only
Mild film grain

38 7/3/8 13348

15

4

19 4/5/14 11381

15

5

14 7/3/8 10013

15

W

29 5/3/12 9262

15

A

10/3/9 11624

15

S



0/6/7 7265

15

9

9/11/1 9988

15

14

1/5/4 8084

15

26

1/6/7 8228

15

1

空格 6/5/2

15

1

11

-

1X

+

18:05 / 21:30

弹幕



Thank you

- We thank Philippe De Lagrange from InterDigital for help to crosscheck the software
- JVET-R0455 provides a crosscheck for the VVC version of the HEVC software example for the FGC SEI message. Other than reference software integration details, the film grain simulation software is identical.

