



**International
Standard**

ISO/IEC 23090-29

**Information technology — Coded
representation of immersive
media —**

**Part 29:
Video-based dynamic mesh coding
(V-DMC)**

*Technologies de l'information — Représentation codée de média
immersifs —*

Partie 29: Codage dynamique de maillages basé vidéo (V-DMC)

**First edition
2026-07**



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Published in Switzerland

Contents

Page

Foreword	vi
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms	8
5 Conventions	9
5.1 General	9
5.2 Arithmetic operators	9
5.3 Logical operators	9
5.4 Relational operators	9
5.5 Bit-wise operators	9
5.6 Assignment operators	9
5.7 Other operators	9
5.8 Mathematical functions	10
5.9 Order of operation precedence	14
5.10 Variables, syntax elements, and tables	14
5.11 Text description of logical operations	14
5.12 Processes	14
5.13 Array operations	14
6 Overall V-DMC characteristics, decoding operations, and post-decoding processes	16
6.1 V-DMC characteristics	16
6.2 V-DMC bitstream characteristics, decoding operations, and post-decoding processes	17
7 Bitstream format, partitioning, and scanning processes	18
7.1 General	18
7.2 V3C bitstream formats	18
7.3 NAL bitstream formats	18
7.4 Partitioning of atlas frames into tiles	18
7.5 Tile partition scanning processes	18
7.6 Extension of partitioning process for tile attribute components	18
8 Syntax and semantics	19
8.1 Method of specifying syntax in tabular form	19
8.2 Specification of syntax functions and descriptors	19
8.3 Syntax in tabular form	19
8.3.1 General	19
8.3.2 V3C unit syntax	19
8.3.3 Byte alignment syntax	19
8.3.4 V3C parameter set syntax	19
8.3.5 NAL unit syntax	21
8.3.6 Raw byte sequence payloads, trailing bits, and byte alignment syntax	22
8.3.7 Atlas tile data unit syntax	30
8.3.8 Supplemental enhancement information message syntax	30
8.3.9 VDMC atlas tile data unit syntax	30
8.4 Semantics	40
8.4.1 General semantics	40
8.4.2 V3C unit semantics	41
8.4.3 Byte alignment semantics	41
8.4.4 V3C parameter set semantics	41
8.4.5 NAL unit semantics	44
8.4.6 Raw byte sequence payloads, trailing bits, and byte alignment semantics	45
8.4.7 Atlas tile data unit semantics	61
8.4.8 Supplemental enhancement information message semantics	61

8.4.9	VDMC atlas tile data unit semantics	61
9	Decoding process	76
9.1	General decoding process	76
9.2	Atlas data decoding process	77
9.2.1	General atlas decoding process	77
9.2.2	Decoding process for a coded atlas frame	77
9.2.3	Atlas NAL unit decoding process	78
9.2.4	Atlas tile header decoding process	78
9.2.5	Decoding process for patch data units	79
9.2.6	Decoding process of the block to patch map	79
9.2.7	Conversion of tile level patch information to atlas level patch information	79
9.2.8	Decoding process for meshpatch data units	80
9.2.9	Conversion of tile level meshpatch information to atlas level meshpatch information	103
9.3	Occupancy video decoding process	106
9.4	Geometry video decoding process	106
9.5	Attribute video decoding process	106
9.6	Packed video decoding process	106
9.7	Common atlas decoding process	106
9.8	Sub-bitstream extraction process	106
9.9	Basemesh decoding process	106
9.10	Displacement decoding process	107
10	Pre-reconstruction process	108
11	Reconstruction process	108
11.1	General	108
11.2	Submesh Reconstruction Process	111
11.2.1	General	111
11.2.2	Texture coordinate derivation	114
11.2.3	Subdivision process	123
11.2.4	Inverse image packing of transform coefficients	142
11.2.5	Inverse quantization	143
11.2.6	Inverse transform	145
11.2.7	Normal, tangent, and bitangent vector generation	147
11.2.8	Vertex coordinates reconstruction	151
11.2.9	Texture coordinate adaptation process	151
11.3	Append submesh to a mesh process	151
12	Post-reconstruction process	152
12.1	General	152
12.2	Zippering process	153
12.2.1	Zippering method by distance	154
12.2.2	Zippering method by index matching	154
12.2.3	Zippering method by boundary connect	155
12.2.4	Identification of boundary vertices	166
12.2.5	Identification of matched boundary vertices by distance	166
12.2.6	Identification of matched boundary vertices by explicit signaling	169
12.2.7	Border vertex fusion	170
12.2.8	Handling of unmatched LoD vertices	171
13	Adaptation process	178
14	Parsing process	178
Annex A (normative) Profiles, tiers, and levels		179
Annex B (informative) Post-decoding conversion to nominal video formats		191
Annex C (informative) V3C sample stream format		201
Annex D (normative) NAL sample stream format		202

Annex E (normative) Atlas hypothetical reference decoder	203
Annex F (normative) Supplemental enhancement information	204
Annex G (informative) Volumetric usability information	234
Annex H (normative) Basemesh sub-bitstream	236
Annex I (normative) MPEG edgebreaker static mesh coding.....	327
Annex J (normative) Arithmetic coded displacement sub-bitstream.....	402
Annex K (normative) Inverse binarization process	466
Annex L (normative) MPEG motion coding.....	477
Bibliography	484

Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology, Subcommittee SC 29, Coding of audio, picture, multimedia and hypermedia information*.

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Introduction

The advances in 3D capture, modelling, and rendering have promoted the ubiquitous presence of 3D content across several platforms and devices.

3D meshes, along with point clouds and immersive video, are widely used to represent such immersive content. A mesh is composed of several polygons that describe the boundary surface of a volumetric object. Each polygon is defined by its vertices in 3D space and the information on how the vertices are connected, referred to as connectivity information. Optionally, vertex attributes, such as colours, normal, etc., can be associated with the mesh vertices. Attributes can also be associated with the surface of the mesh by exploiting mapping information that describes a parameterization of the mesh onto 2D regions of the plane. Such mapping is usually described by a set of parametric coordinates, referred to as UV coordinates or texture coordinates. 2D attribute maps are used to store high resolution attribute information such as texture, normal, material ID etc. Such information can be used for various purposes such as texture mapping and shading.

To achieve a realistic representation of an object or scene, 3D meshes are becoming increasingly sophisticated, and a significant amount of data is generated for the creation and consumption of those meshes. When uncompressed, these data can be costly in terms of storage and transmission. Furthermore, dynamic mesh sequences may require even larger amounts of data, since it may consist of a significant quantity of information changing over time. A visual volumetric video-based coding (V3C) standard has been created to support the distribution of volumetric data, currently addressing point clouds (ISO/IEC 23090-5) and immersive video content (ISO/IEC 23090-12). Therefore, this document was developed to support compression of 3D video-based mesh coding utilizing the ISO/IEC V3C standard (ISO/IEC 23090-5).

Information technology — Coded representation of immersive media —

Part 29: Video-based dynamic mesh coding (V-DMC)

1 Scope

This document specifies syntax, semantics, and decoding for video based dynamic mesh coding (V-DMC), basemesh coding, MPEG edgebreaker static mesh coding, and arithmetic coded displacement. Furthermore, this document specifies processes that can be used for reconstruction of visual volumetric media and also include additional processes such as post-decoding, pre-reconstruction, post-reconstruction, and adaptation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO /IEC 23090-5:2026, *Information technology — Coded Representation of Immersive Media — Part 5: Visual volumetric video-based coding (V3C) and video-based point cloud compression (V-PCC)*

Bibliography

- [1] SMPTE VC-2, *Society of Motion Picture and Television Engineers ST 2042-1 (2017), VC-2 Video Compression*
- [2] ISO/IEC 14496-10, *Information technology — Coding of audio-visual objects — Part 10: Advanced video coding*