International Standard

ISO/CIE 11664-5

Colorimetry —

Part 5: CIE 1976 L*u*v* colour space and u', v' uniform chromaticity scale diagram

Colorimétrie —

*Partie 5: Espace chromatique L*u*v* et diagramme de chromaticité uniforme u', v' CIE 1976*

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11

Email: copyright@iso.org
Website: www.iso.org

CIE Central Bureau
Babenbergerstraße 9/9A • A-1010 Vienna

Phone: +43 1 714 3187
Fax: +41 22 749 09 47
Email: ciecb@cie.co.at
Website: www.cie.co.at

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Foreword

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This second edition cancels and replaces the first edition (ISO/CIE 11664-5:2016), which has been technically revised.

The main changes are as follows:

— list of ISO/CIE 11664 series *Colorimetry* shifted from Foreword to Introduction;

— text in 3.1, 4.2, 4.3, and 4.4 updated;

— previous Formula (24) deleted and related formula numbers updated accordingly;

— sign in Formula (26) updated;

— Bibliography updated;

— minor editorial changes.

A list of all parts in the ISO/CIE 11664 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The three-dimensional colour space produced by plotting CIE tristimulus values (*X*,*Y*,*Z*) in rectangular coordinates is not visually uniform, nor is the (x,y,Y) space nor the two-dimensional CIE x,y chromaticity diagram. Equal distances in these spaces and diagrams do not represent equally perceptible differences between colour stimuli. For this reason, in 1976, the CIE introduced and recommended two new spaces (known as CIELAB and CIELUV) whose coordinates are non-linear functions of *X*, *Y* and *Z*. The recommendation was put forward in an attempt to unify the then very diverse practice in uniform colour spaces and associated colour difference formulae.[2][8] Both these more-nearly uniform colour spaces have become well accepted and widely used. Numerical values representing approximately the relative magnitude of colour differences can be described by simple Euclidean distances in the spaces or by more sophisticated formulae that improve the correlation with the relative perceived size of differences.

The purpose of this document is to specify procedures for calculating the coordinates of the CIE 1976 L*u*v* (CIELUV) colour space and the Euclidean colour difference values based on these coordinates. This document also specifies a related chromaticity diagram that is a projection of the CIE x,y chromaticity diagram maintaining straight lines of dominant and complementary wavelengths. It does not cover the alternative uniform colour space, CIELAB,[5] nor does it cover more sophisticated colour difference formulae based on CIELAB, such as the CMC formula,[3] the CIE 94 formula,[1] the DIN 99 formula,[4] and the CIEDE2000 formula[6].

The ISO/CIE 11664 series consists of the following parts, under the general title *Colorimetry*:

— *Part 1: CIE standard colorimetric observers*

— *Part 2: CIE standard illuminants*

— *Part 3: CIE tristimulus values*

— *Part 4: CIE 1976 L*a*b* Colour space*

— *Part 5: CIE 1976 L*u*v* Colour space and u′, v′ uniform chromaticity scale diagram*

— *Part 6: CIEDE2000 Colour-difference formula*

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Colorimetry —

Part 5: CIE 1976 L*u*v* colour space and u', v' uniform chromaticity scale diagram

1 Scope

This document specifies the method of calculating the coordinates of the CIE 1976 L*u*v* colour space including correlates of lightness, chroma, saturation and hue. It includes two methods for calculating Euclidean distances in this space to represent the relative perceived magnitude of colour differences. It also specifies the method of calculating the coordinates of the u′,v′ uniform chromaticity scale diagram.

This document is applicable to tristimulus values calculated using the colour-matching functions of the CIE 1931 standard colorimetric system or the CIE 1964 standard colorimetric system. This document is applicable for the specification of colour stimuli perceived as belonging to a reflecting or transmitting object, where a three-dimensional space more uniform than tristimulus space is required. This includes self-luminous displays, like computer, television and smart-phone displays, if they are being used to simulate reflecting or transmitting objects and if the stimuli are appropriately normalized.

This document, as a whole, does not apply to colour stimuli perceived as belonging to an area that appears to be emitting light as a primary light source or that appears to be specularly reflecting such light. Only the u′,v′ uniform chromaticity scale diagram defined in 4.1 and the correlates of hue and saturation defined in 4.3 apply to such colour stimuli.

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/CIE 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO/CIE 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

CIE maintains a terminological database for use in standardization at the following address:

— ILV: International Lighting Vocabulary: available at https://cie.co.at/e-ilv

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