
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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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TC 274, *Light and lighting*.

This first edition of ISO/CIE 11664-5 cancels and replaces ISO 11664-5:2009, of which it constitutes a minor revision. (ISO 11664-5:2009 was prepared by CIE Technical Committee TC 1-57 of Division 1.)

ISO 11664 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*

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

- Part 5: *CIE 1976 $L^*a^*b^*$ colour space and u', v' uniform chromaticity scale diagram*
- Part 6: *CIEDE2000 colour-difference formula*

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 part of ISO/CIE 11664 is to define 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 part of ISO/CIE 11664 also defines a related chromaticity diagram that is a projection of the CIE x, y chromaticity diagram maintaining straight lines of dominant and complementary wavelengths. This part of ISO/CIE 11664 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]

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Colorimetry —

Part 5:

CIE 1976 $L^*u^*v^*$ colour space and u', v' uniform chromaticity scale diagram

1 Scope

This part of ISO/CIE 11664 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 part of ISO/CIE 11664 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 part of ISO/CIE 11664 may be used 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 cathode ray tubes, if they are being used to simulate reflecting or transmitting objects and if the stimuli are appropriately normalized. This part of ISO/CIE 11664, 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11664-1/CIE S 014-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO 11664-2/CIE S 014-2, *Colorimetry — Part 2: CIE standard illuminants*

CIE S 017, *ILV: International Lighting Vocabulary*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in CIE S 017 apply.