SMPTE STANDARD

Spectral Similarity Index (SSI)

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Foreword

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SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual. This SMPTE Engineering Document was prepared by Technology Committee 10E.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

The Spectral Similarity Index (SSI) is a measure of the similarity of the relative spectral distribution of a test source to that of a reference source or illuminant, expressed as a single metric reported on a 100-point scale. The more similar a test-source spectral distribution is to that of a reference, the more confidence a user can have that the test source will be an acceptable replacement for the reference source or illuminant.

SSI was developed by the Academy of Motion Picture Arts and Sciences' Science and Technology Council to provide an improved measure of the predictability of colors captured with artificial lighting – in particular with LED luminaires – for motion picture photography. The Color Rendering Index (CRI) and other similar metrics are based on human vision and are not designed considering camera characteristics. There is no spectral-sensitivity standard for cinema cameras, so a metric for cinema-lighting quality cannot presume a particular set of sensitivities. SSI compares a cinema light source to a chosen known, satisfactory, reference (typically daylight or tungsten), and provides a measure of the similarity of their spectra, independent of any particular camera sensitivity characteristics or surface spectral reflectances.

Although SSI is applicable for most sources, it is primarily intended for use with "white" sources of various correlated color temperatures.

1 Scope

This standard specifies the method for calculating the Spectral Similarity Index (SSI) and the notation for the index and its reference spectral distribution. SSI can be used to evaluate how similarly one can expect two light sources to work with, or in place of, each other for motion-picture photography. It is also suitable for other lighting applications.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: “shall”, “should”, or “may”. Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as “Informative” or individual paragraphs that start with “Note:”

The keywords “shall” and “shall not” indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords “should” and “should not” indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords “may” and “need not” indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions (“shall”) and, if implemented, all recommended provisions (“should”) as described. A conformant implementation need not implement optional provisions (“may”) and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; then formal languages; then figures; and then any other language forms.

3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this engineering document. At the time of publication, the editions indicated were valid. All standards are subject

to revision, and parties to agreements based on this engineering document are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

CIE 015:2018 Colorimetry, 4th Edition

CIE 204:2013 Methods for Re-defining CIE D Illuminants

ISO 7589:2002(E) Photography — Illuminants for sensitometry — Specifications for daylight, incandescent tungsten and printer

ISO 11664-2:2007 Colorimetry — Part 2: CIE standard illuminants

4 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

4.1 CIE illuminant

illuminant specified by the International Commission on Illumination (CIE)

4.2 correlated color temperature

CCT

T_{cp}

temperature of a Planckian radiator having the chromaticity nearest the chromaticity associated with the given spectral distribution on a diagram where the (CIE 1931 standard observer based) u', $2/3v'$ coordinates of the Planckian locus and the test stimulus are depicted

Unit: K

[SOURCE: CIE DIS 017/E:2016 ILV, 17-23-068]

4.3 Planckian radiator

blackbody

ideal thermal radiator that absorbs completely all incident radiation, whatever the wavelength, the direction of incidence or the polarization

[SOURCE: CIE DIS 017/E:2016 ILV, 17-24-004]