Associazione Nazionale
Produttori Illuminazione

LIGHTING OPEN DAY

19 ottobre 2016, Milano

FLICKER E EFFETTO STROBOSCOPICO

Temporal Light Artefacts

FLICKER E EFFETTO STROBOSCOPICO

- Definizioni
- Normative e metrica
- LE position paper

DEFINIZIONI

flicker

perception of visual unsteadiness induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a static observer in a static environment (CIE TN 006:2016)

DEFINIZIONI

stroboscopic effect

change in motion perception induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a static observer in a non-static environment (CIE TN 006:2016)

DEFINIZIONI

phantom array effect

ghosting

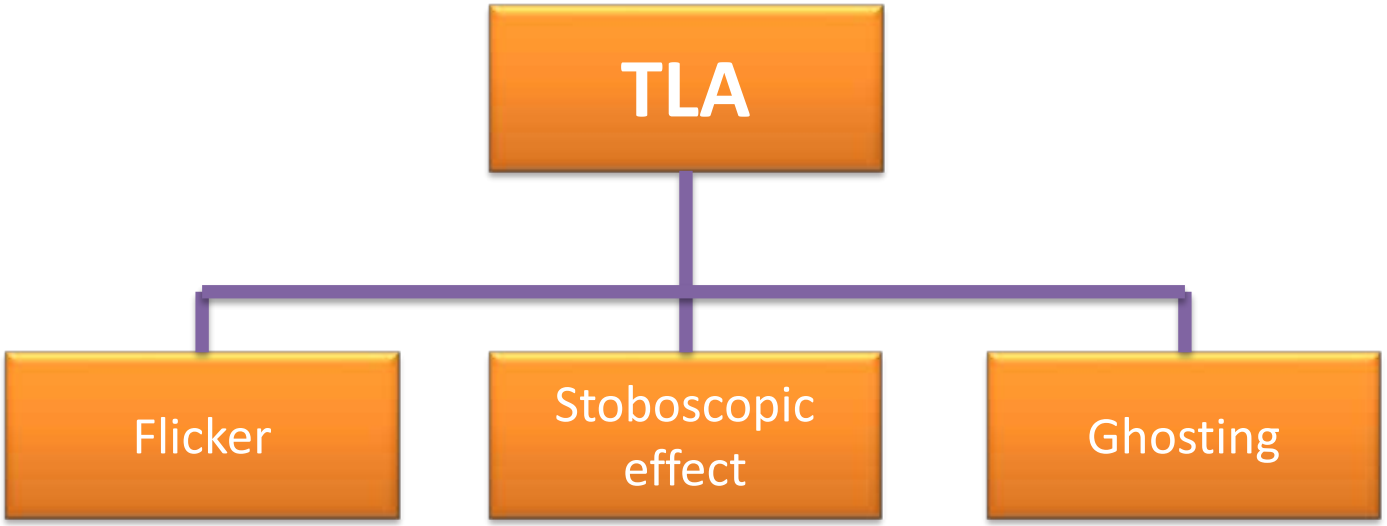
change in perceived shape or spatial positions of objects, induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a non-static observer in a static environment (CIE TN 006:2016)

DEFINIZIONI

temporal light artefact

TLA

change in visual perception, induced by a light stimulus the luminance or spectral distribution of which fluctuates with time, for a human observer in a specified environment



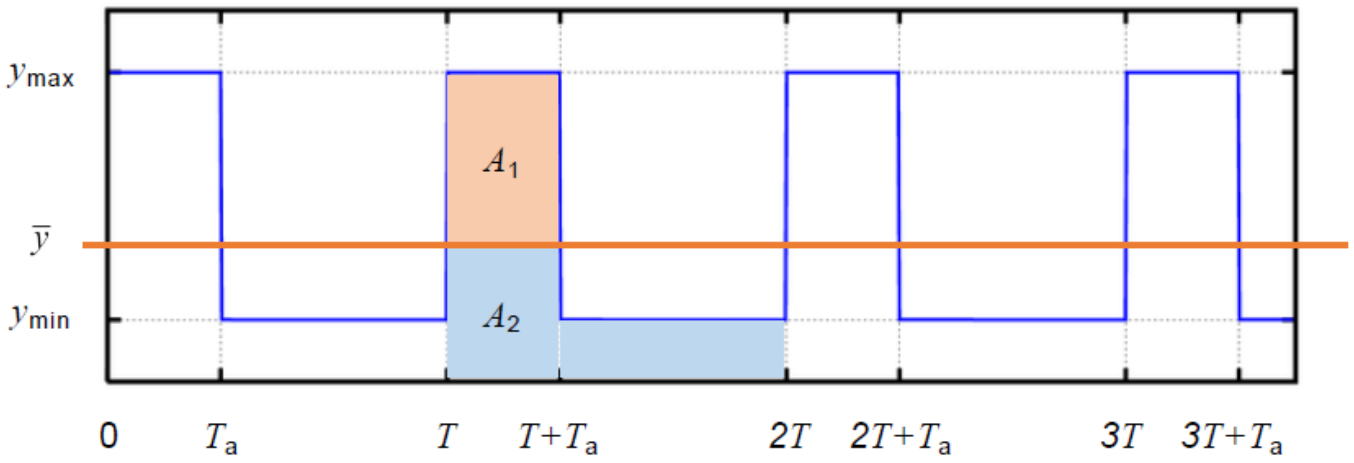
DEFINIZIONI

Flicker index: FI

$$I_F = \frac{A_1}{A_1 + A_2}$$

Percent Flicker (PF)

$PF = 100 \times (y_{max} - y_{min})/(y_{max} + y_{min})$



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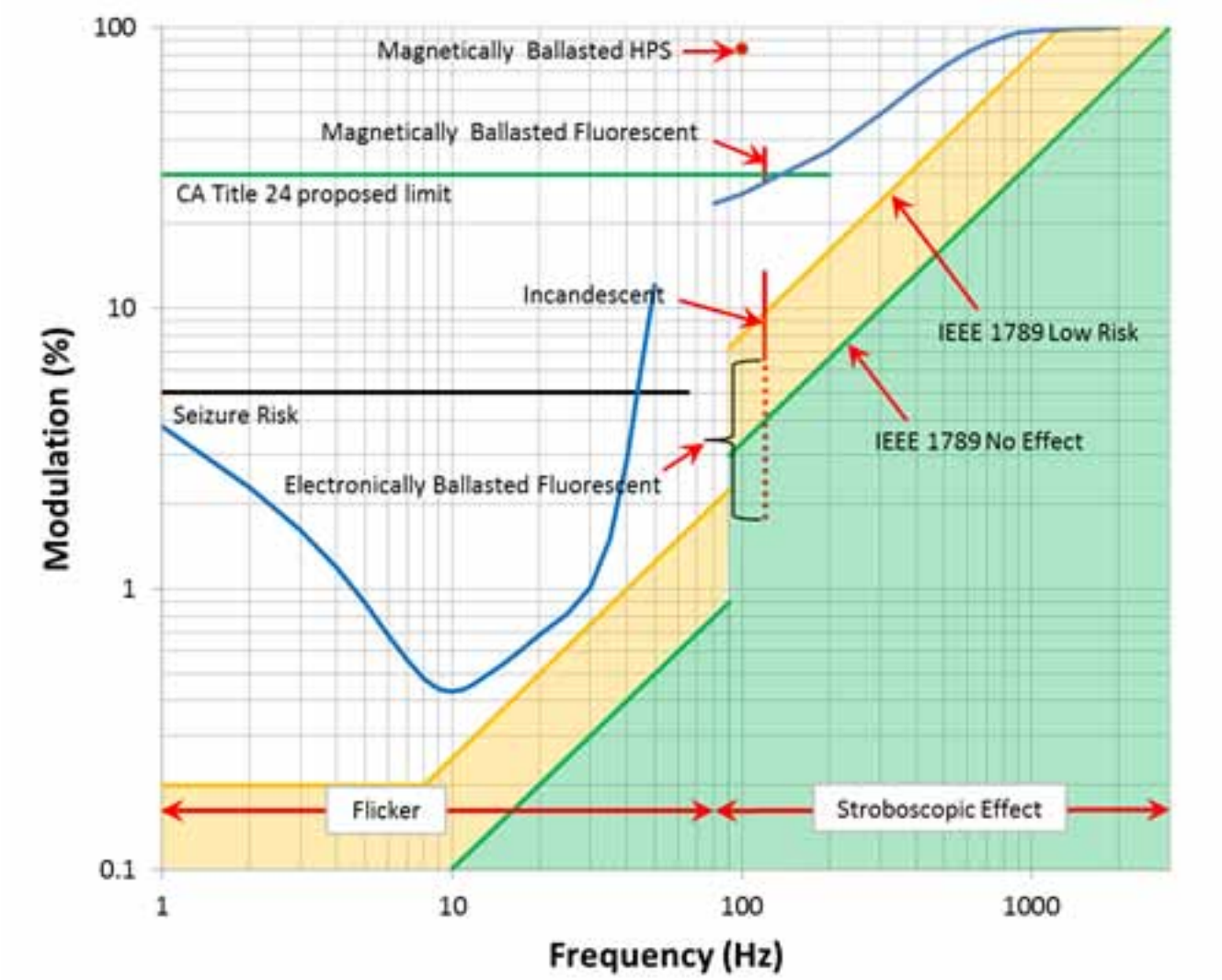
NORMATIVE E METRICA

IEEE 1789:2015



NORMATIVE E METRICA

flicker: IEC TR 61547-1

Origine dl flicker in IEC:

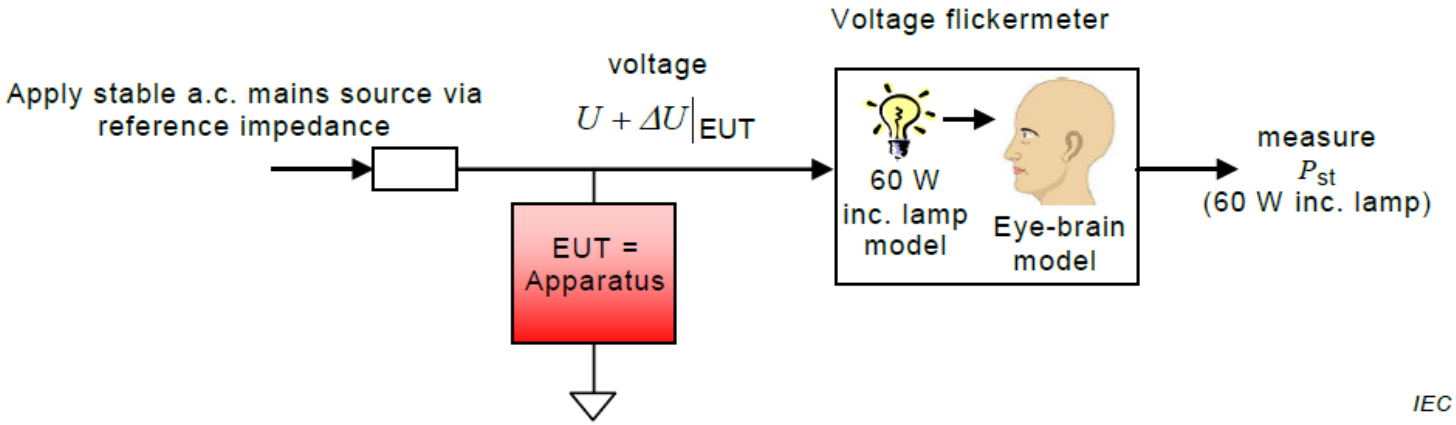
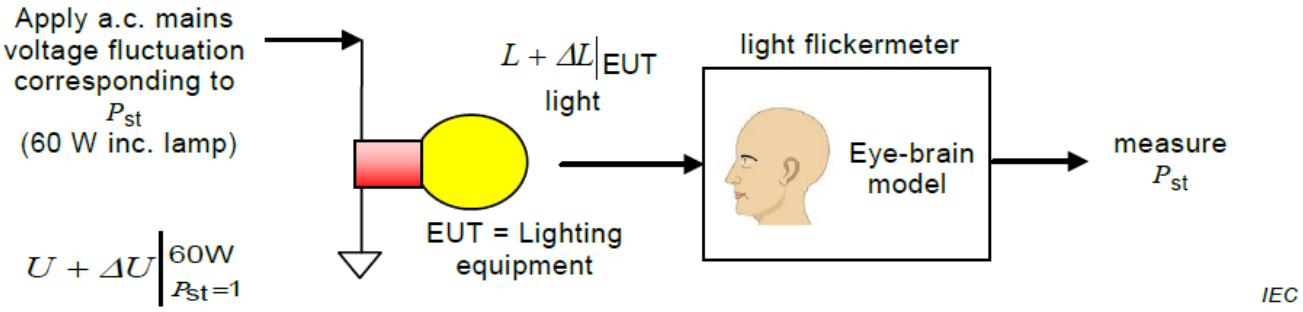


Figure 1a – Voltage fluctuation emission test IEC 61000-3-3, using the IEC voltage flickermeter IEC 61000-4-15

NORMATIVE E METRICA

IEC TR 61547-1 (flicker)

Valutazione di una sorgente in caso di fluttuazioni di tensioni



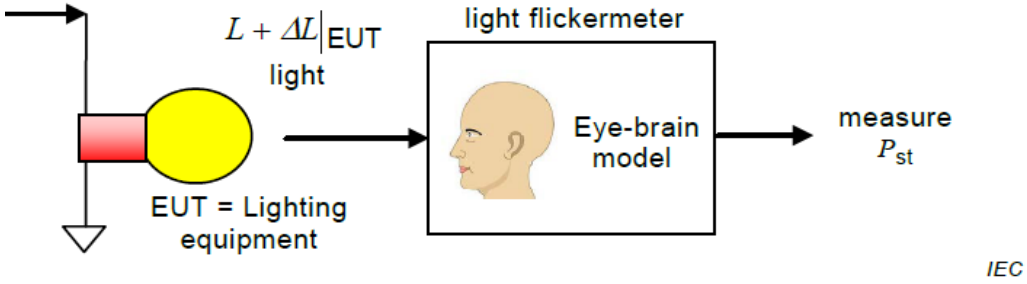
se P_{st} >1: flicker visibile

se P_{st} <1: flicker non visibile

NORMATIVE E METRICA

IEC TR 61547-1 (flicker)

Il metodo di prova descritto in questa norma per determinare il valore $\mathbf{P^{LM}_{st}}$ può essere utilizzato per valutare il flicker di una sorgente anche in condizioni stabili di tensione



se P^{LM}_{st} >1: flicker visibile

se P^{LM}_{st} <1: flicker non visibile

NORMATIVE E METRICA

IEC TR 61547-1 (flicker)

struttura del flickermeter: IEC 61000-4-15

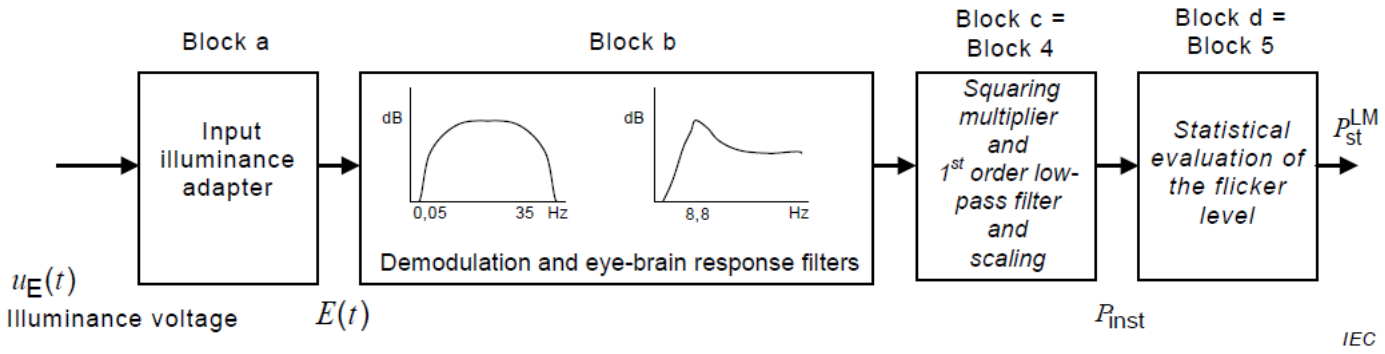


Figure A.2 – Structure of the light flickermeter

NORMATIVE E METRICA

Stroboscopic effect

SVM metrics: CIE TN 006: 2016

cie
International Commission on Illumination
Commission Internationale de l'Eclairage
Internationale Beleuchtungskommission

TECHNICAL NOTE

Visual Aspects of Time-Modulated Lighting Systems – Definitions and Measurement Models

CIE TN 006:2016

NORMATIVE E METRICA

Stroboscopic effect

SVM metrics: CIE TN 006: 2016

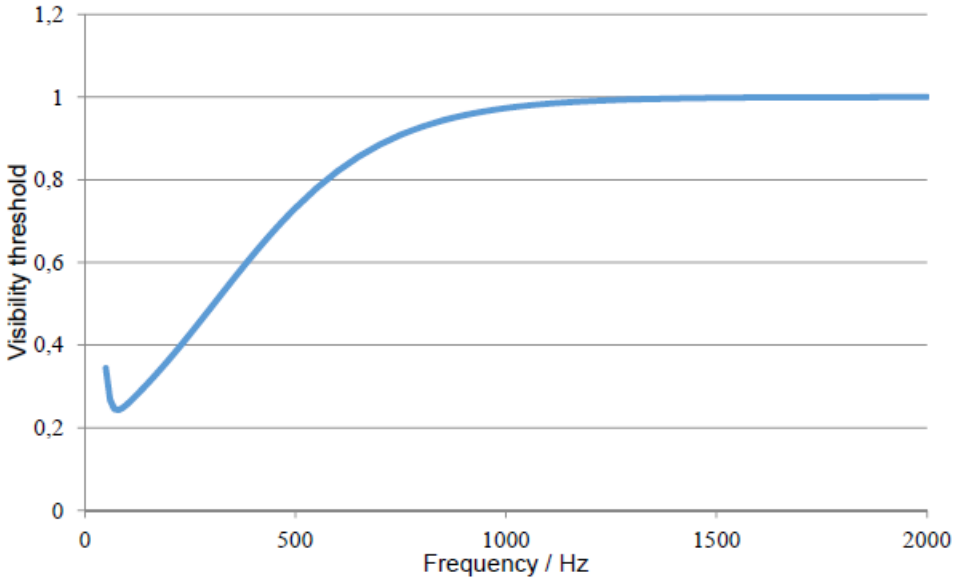


Figure 4 – SVM sensitivity curve

NORMATIVE E METRICA

Stroboscopic effect

SVM metrics: CIE TN 006: 2016

Mv: Visibility measure

$$M_v = \left(\sum_{m=1}^{\infty} \left(\frac{C_m}{T_m} \right)^n \right)^{1/n}$$

where C^m *is the amplitude of the m-th Fourier component and* T^m *is the visibility threshold for the effect for a sine wave at the frequency of the m-th Fourier component. The parameter n is the Minkowski norm parameter*

If the value of the visibility measure equals to one, the input modulation produces a temporal light artefact that is just visible, i.e. at visibility threshold.

NORMATIVE E METRICA

Stroboscopic effect

SVM metrics: CIE TN 006: 2016

Mv: Visibility measure

se SVM >1: effetto stroboscopico visibile

se SVM <1: effetto stroboscopico non visibile

NORMATIVE E METRICA

Stroboscopic effect

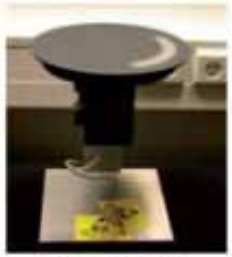
SVM metrics: CIE TN 006: 2016

$$SVM = \left(\sum_{m=1}^{\infty} \left| \frac{C_m}{T_m} \right|^n \right)^{1/n}$$

- < 1 not visible
- = 1 just visible
- > 1 visible

The visibility measure corresponds to the summation of all Fourier components (Cm), divided by the flicker visibility threshold of a sine wave at the corresponding frequency (Tm)

LEDs Test :



SVM < 1

SVM = 1

SVM > 1

NORMATIVE E METRICA

Proposte di normazione in sede IEC:

- **Revisione IEC TR 61547-1:** per rendere il flickermeter (P^{LM}_{st}) applicabile a tutte le sorgenti anche in assenza di variazioni di tensione

- **Proposta di nuovo TR** per per la misura del SVM in linea con il documento CIE TN 006

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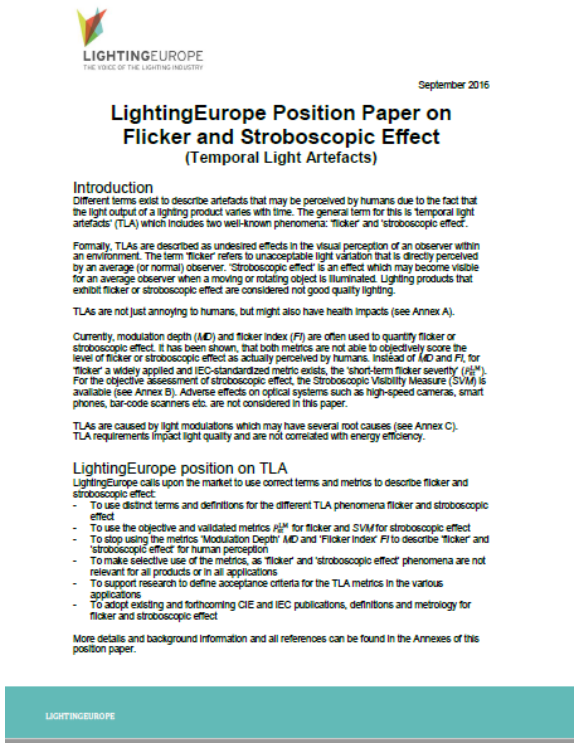
LE POSITION PAPER



LIGHTINGEUROPE
THE VOICE OF THE LIGHTING INDUSTRY

September 2016

LightingEurope Position Paper on Flicker and Stroboscopic Effect
(Temporal Light Artefacts)

Introduction

Different terms exist to describe artefacts that may be perceived by humans due to the fact that the light output of a lighting product varies with time. The general term for this is 'temporal light artefacts' (TLA) which includes two well-known phenomena: 'flicker' and 'stroboscopic effect'.

Formally, TLAs are described as undesired effects in the visual perception of an observer within an environment. The term 'flicker' refers to unacceptable light variation that is directly perceived by an average (or normal) observer. 'Stroboscopic effect' is an effect which may become visible for an average observer when a moving or rotating object is illuminated. Lighting products that exhibit flicker or stroboscopic effect are considered not good quality lighting.

TLAs are not just annoying to humans, but might also have health impacts (see Annex A).

Currently, modulation depth (*MD*) and flicker index (*FI*) are often used to quantify flicker or stroboscopic effect. It has been shown, that both metrics are not able to objectively score the level of flicker or stroboscopic effect as actually perceived by humans. Instead of *MD* and *FI*, for 'flicker' a widely applied and IEC-standardized metric exists, the 'short-term flicker severity' (P_{st}^{LM}). For the objective assessment of stroboscopic effect, the Stroboscopic Visibility Measure (*SVM*) is available (see Annex B). Adverse effects on optical systems such as high-speed cameras, smart phones, bar-code scanners etc. are not considered in this paper.

TLAs are caused by light modulations which may have several root causes (see Annex C). TLA requirements impact light quality and are not correlated with energy efficiency.

LightingEurope position on TLA

LightingEurope calls upon the market to use correct terms and metrics to describe flicker and stroboscopic effect:

- To use distinct terms and definitions for the different TLA phenomena flicker and stroboscopic effect
- To use the objective and validated metrics P_{st}^{LM} for flicker and *SVM* for stroboscopic effect
- To stop using the metrics 'Modulation Depth' *MD* and 'Flicker Index' *FI* to describe 'flicker' and 'stroboscopic effect' for human perception
- To make selective use of the metrics, as 'flicker' and 'stroboscopic effect' phenomena are not relevant for all products or in all applications
- To support research to define acceptance criteria for the TLA metrics in the various applications
- To adopt existing and forthcoming CIE and IEC publications, definitions and metrology for flicker and stroboscopic effect

More details and background information and all references can be found in the Annexes of this position paper.

LIGHTINGEUROPE

Questo position paper è stato emesso per due scopi:

- Indicare alla commissione che il fenomeno flicker non ha nulla a che fare con la direttiva Eco design
- L'introduzione di una proposta di matrica per la valutazione TLA (flickering and stroboscopic affects) per applicazioni illumnotecniche.

LE POSITION PAPER

Currently, modulation depth (*MD) and flicker index (FI) are often used to quantify flicker or stroboscopic effect. It has been shown, that both metrics are not able to objectively score the level of flicker or stroboscopic effect as actually perceived by humans. Instead of MD and FI, for 'flicker' a widely applied and IEC-standardized metric exists, the 'short-term flicker severity' ($P_{\mathrm{st}}^{\mathrm{LM}}$). For the objective assessment of stroboscopic effect, the Stroboscopic Visibility Measure (SVM) is available (see Annex B). Adverse effects on optical systems such as high-speed cameras, smart phones, bar-code scanners etc. are not considered in this paper.*

SI RINGRAZIA PER L'ATTENZIONE

per eventuali approfondimenti:

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