MEASUREMENT OF TEMPORAL LIGHT MODULATION: IMPROVING CALCULATION METHODS FOR STROBOSCOPIC EFFECT VISIBILITY MEASURE

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The International Energy Agency (IEA) 4E Solid State Lighting Annex is conducting an Interlaboratory Comparison (IC 2022) focused on the measurement of temporal light modulation (TLM) from solid state lighting (SSL) products. IC 2022 will compare measured TLM waveform data and calculated *short term flicker index* (P_{st}^{LM}) in IEC TR 61547-1 [1] and *stroboscopic effect visibility measure* (SVM, M_{VS}) in IEC TR 63158 [2] for both a range of LED sample lamps and also a TLM generator. In preparation for IC 2022, calculation methods for SVM are reviewed, noting that the method used to calculate the SVM of a specific TLM waveform influences the uncertainty of the determined value. Specifically, using the commonly applied MATLAB toolbox [3] for calculation of SVM for the verification waveforms given in Annex A.5 of IEC TR 63158 yields large uncertainties, in the order of 0.2% - 2.2%. Furthermore, using this method, the uncertainty is found to vary with sampling frequencies ranging from 20 kHz to 50 kHz.

Dam-Hansen et al recently reported improvements [4] to the SVM calculation method that minimise uncertainty in determined values. The method is shown to increase the accuracy and reduce the uncertainty in the SVM numerical calculation of verification waveforms when compared to the referenced toolbox method. In addition, the improved method removes the large variations in SVM calculation as a function of sampling frequency.

In the context of the IC 2022, it is important that the uncertainty associated with the SVM calculations is minimised and remains consistent across a range of TLM waveform measurement parameters (e.g., sampling frequency and duration) arising from the different measurement systems used by participating laboratories.

This presentation will discuss the two methods identified for improving the accuracy and precision of determined values for SVM of LED light sources and briefly explain the importance of such to an interlaboratory comparison activity.

References

[1] IEC, 2020. IEC TR 1547-1:2020 Equipment for general lighting purposes – EMC immunity requirements – Part 1: Objective light flickermeter and voltage fluctuation immunity test method. *IEC*

[2] IEC, 2018. IEC TR 63158:2018 Equipment for general lighting purposes. Objective test method for stroboscopic effects of lighting equipment. *IEC.*

[3] BANERJEE, K., 2022. Stroboscopic effect visibility measure toolbox *[WWW Document]. URL https://se.mathworks.com/matlabcentral/fileexchange/59242-stroboscopic-effect-visibility-measure-toolbox (accessed 9.8.22).*

[4] DAM-HANSEN, C., COYNE, S., ISOARDI, G., OHNO, Y., 2022. Minimising the uncertainties in the calculation of stroboscopic effect visibility measure. *Proceedings of the CIE Symposium on Advances on the Measurement of Temporal Light Modulation, Athens, Greece, October 11, 2022*