Quantifying Photometric Spectral Mismatch Uncertainties in LED Measurements

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The “goodness of fit” parameter, f_1', is widely used as a quality indication in the selection of photometers. This parameter is well suited to white light sources, but does not adequately indicate performance for LEDs (with the possible exception of white LEDs). Calculation of f_1' requires a knowledge of the spectral response of the detector. If the spectral distribution of the LED is also known, spectral mismatch correction factors can be calculated which compensate results for the photopic matching errors. However, during production and testing the spectrum is often not known for each device. Normal variations between devices of the same type give slight differences in peak wavelength and other parameters. If spectral mismatch correction is applied to a “typical” device, the differences between devices can be envisaged as introducing uncertainties in the spectral mismatch correction factor. These uncertainties are not constant, and depend on the matching of the photometer response to the V(λ) function over a relatively short wavelength range rather than the full visible region.

A new parameter, f_{LED}, is proposed which indicates the suitability of a photometer to measure a particular type of LED on the basis of spectral mismatch uncertainty over the appropriate region. It requires only the photometer spectral response function, as in the case of f_1' calculation, and hence may be generated by those manufacturer’s currently providing such information without additional measurements. Some examples will be shown to prove the usefulness of the new function f_{LED} in determining photometric quantities of LEDs with various photometers.