The three coordinates of the CIELUV colour space are given by the expressions:

$$L^\star = (116\,(Y/Y_n)\,0.33 - 16) \text{ for } Y/Y_n > 0.008856$$

$$L^\star = 903.29\,(Y/Y_n) \text{ for } Y/Y_n \leq 0.008856$$

$$u^\star = 13\,L^\star\,(u' - u'_n)$$

$$v^\star = 13\,L^\star\,(v' - v'_n)$$

where u' and v' are the chromaticity coordinates from the CIE 1976 UCS diagram and u'_n, v'_n, Y_n are values for a nominally achromatic colour, usually the surface with 100% reflectance ($Y = 100$) lit by the light source.

The three coordinates of the CIELAB colour space are given by the expressions:

$$L^\star = 116\,f\,(Y/Y_n) - 16$$

$$a^\star = 500\,(f(X/X_n) - f(Y/Y_n))$$

$$b^\star = 200(f(Y/Y_n) - f(Z/Z_n))$$

where $f(q) = q^{0.33}$ for $q > 0.008856$ and $f(q) = 7.787\,q + 0.1379$ for $q \leq 0.008856$

$$q = X/X_n \text{ or } Y/Y_n \text{ or } Z/Z_n$$

Again, X_n, Y_n, Z_n are the values of the X, Y and Z for a nominally achromatic surface, usually that of the light source with $Y_n = 100$.

Each of these colour spaces have a colour difference formula associated with them. For the CIELUV colour space, the colour difference is given by

$$E^\star_{uv} = ((L^\star)^2 + (u^\star)^2 + (v^\star)^2)^{0.5}$$

For the CIELAB colour space, the colour difference is given by

$$E^\star_{ab} = ((L^\star)^2 + (a^\star)^2 + (b^\star)^2)^{0.5}$$

These two colour spaces are now widely used to set colour tolerances for manufacture in many industries.

1.4.3 Correlated colour temperature

While the CIE colourimetry system is the most exact means of quantifying colour, it is complex. Therefore, the lighting industry has used the CIE colourimetry system to derive two single-number metrics to characterise the colour properties of light sources. The metric used to characterise the colour appearance of the light emitted by a light source is the correlated colour temperature. The basis of this measure is the fact that the spectral power distribution of a black body is defined by Planck's Radiation Law and hence is a function of its temperature only (see Section 3.1.1).