The following document contains the CIEDE2000 equations. In order to resolve the perceptual uniformity issue, the CIE added five corrections:

- A hue rotation term (R_T), used to deal with the problematic blue region (hue angles in the neighborhood of 275°).
- Compensation for neutral colors (the primed values in the $L^\star C^\star h$ differences).
- Compensation for lightness (S_L).
- Compensation for chroma (S_C).
- Compensation for hue (S_H).

Note: The formulas below should use degrees rather than radians; the issue is significant for R_T. The k_L, k_C, and k_H are usually unity.

$$\Delta E^\star_{00} = \sqrt{\left(\frac{\Delta L'}{k_L S_L}\right)^2 + \left(\frac{\Delta C'}{k_C S_C}\right)^2 + \left(\frac{\Delta H'}{k_H S_H}\right)^2 + R_T \frac{\Delta C'}{k_C S_C}\frac{\Delta H'}{k_H S_H}} \tag{1}$$

$$\Delta L' = L^\star_2 - L^\star_1 \tag{2}$$

$$\bar{L} = \frac{L^\star_1 + L^\star_2}{2}, \bar{C} = \frac{C^\star_1 + C^\star_2}{2} \tag{3}$$

$$a'_i = a^\star_i + \frac{a^\star_i}{2}\left(1 - \sqrt{\frac{\bar{C}^7}{\bar{C}^7 + 25^7}}\right), i = 1, 2 \tag{4}$$

$$\bar{C}' = \frac{C'_1 + C'_2}{2} \tag{5}$$

$$\Delta C' = C'_2 - C'_1 \tag{6}$$

$$C'_i = \sqrt{a'^2_i + b^2_i}, i = 1, 2 \tag{7}$$

$$h'_i = \tan^{-1}(b^\star_i, a'_i) \mod 360^\circ \tag{8}$$

$$\Delta h' = \begin{cases} h'_2 - h'_1, & |h'_1 - h'_2| \le 180^\circ \\ h'_2 - h'_1 + 360^\circ, & |h'_1 - h'_2| > 180^\circ, h'_2 \le h'_1 \\ h'_2 - h'_1 - 360^\circ, & |h'_1 - h'_2| > 180^\circ, h'_2 > h'_1 \end{cases} \tag{9}$$

$$\Delta H' = 2\sqrt{C'_1 C'_2}\sin\left(\frac{\Delta h'}{2}\right) \tag{10}$$

$$\bar{H}' = \begin{cases} \frac{h'_1 + h'_2}{2}, & |h'_1 - h'_2| \le 180^\circ \\ \frac{h'_1 + h'_2 + 360^\circ}{2}, & |h'_1 - h'_2| > 180^\circ, h'_1 + h'_2 < 360^\circ \\ \frac{h'_1 + h'_2 - 360^\circ}{2}, & |h'_1 - h'_2| > 180^\circ, h'_1 + h'_2 \ge 360^\circ \end{cases} \tag{11}$$

$$T = 1 - 0.17\cos(\bar{H}' - 30^\circ) + 0.24\cos(2\bar{H}') + 0.32\cos(3\bar{H}' + 6^\circ) - 0.20\cos(4\bar{H}' - 63^\circ) \tag{12}$$

$$S_L = 1 + \frac{0.015(\bar{L} - 50)^2}{\sqrt{20 + (\bar{L} - 50)^2}} \tag{13}$$

$$S_C = 1 + 0.045\bar{C}' \tag{14}$$

$$S_H = 1 + 0.015\bar{C}'T \tag{15}$$

$$R_T = (-2)\sqrt{\frac{\bar{C}'^7}{\bar{C}'^7 + 25^7}}\sin\left[60^\circ \exp\left(-\left[\frac{\bar{H}' - 275^\circ}{25^\circ}\right]^2\right)\right] \tag{16}$$

More information can be obtained in [1].

REFERENCES

[1] G. Sharma, W. Wu, and E. N. Dalal, "The CIEDE2000 color-difference formula: Implementation notes, supplementary test data, and mathematical observations," *COLOR Research Appl.*, vol. 30, pp. 21–30, Feb. 2005.