

color space CIELAB 1976, color values, -attributes, -chromaticities (a' , b')

tristimulus values X , Y , Z $\rightarrow$ color attributes L^* , a^* , b^*

$$\begin{aligned}\text{lightness} & L^* = 116 (Y/Y_n)^{1/3} - 16 \\ \text{RG-chromaticness} & a^* = 500 [(X/X_n)^{1/3} - (Y/Y_n)^{1/3}] = 500 [a' - a'_n] Y^{1/3} \\ \text{JB-chromaticness} & b^* = 200 [(Y/Y_n)^{1/3} - (Z/Z_n)^{1/3}] = 500 [b' - b'_n] Y^{1/3}\end{aligned}$$

color attributes L^* , a^* , b^* $\rightarrow$ tristimulus values X , Y , Z

$$\begin{aligned}\text{tristimulus values} & X = X_n [(L^* + 16) / 116 + a^*/500]^3 \\ & Y = Y_n [(L^* + 16) / 116]^3 \\ & Z = Z_n [(L^* + 16) / 116 - b^*/200]^3\end{aligned}$$

chromaticity for CIELAB 1976, LABHNU 1977, LABHNU_x 1979

$$\begin{array}{lll}\text{CIELAB 1976, } 2^0 & a' = 0,2191 (x/y)^{1/3} & b' = -0,08376 (z/y)^{1/3} \\ \text{LABHNU 1977} & a' = (x/y + 1/6)^{1/3} / 4 & b' = - (z/y + 1/6)^{1/3} / 12 \\ \text{LABHNU1 1979} & a' = (x/y + 1) / 15 \quad \text{linear!} & b' = - (z/y + 1/6)^{1/3} / 12 \\ \text{LABHNU2 1979} & a' = (x/y + 1/6)^{2/3} / 15 & b' = - (z/y + 1/6)^{1/3} / 12 \\ \text{CIELAB 1976, } 10^0 & a' = 0,2193 (x_{10} / y_{10})^{1/3} & b' = -0,08417 (z_{10} / y_{10})^{1/3} \\ \text{chromaticity constants} & a_2 = 500 (1/X_n)^{1/3} = 0,2191 & b_2 = -200 (1/Z_n)^{1/3} = -0,08376 \\ \text{CIELAB, } 2^0, 10^0 & a_{10} = 500 (1/X_{n10})^{1/3} = 0,2193 & b_{10} = -200 (1/Z_{n10})^{1/3} = -0,08417\end{array}$$