Формулы преобразования цветовых моделей

1. RGB-CMYK
   CMYK-RGB

$$K = \min(1 - R/255, 1 - G/255, 1 - B/255)$$
$$C = (1 - R/255 - K)/(1 - K)$$
$$M = (1 - G/255 - K)/(1 - K)$$
$$Y = (1 - B/255 - K)/(1 - K)$$

$$R = 255(1 - C)(1 - K)$$
$$G = 255(1 - M)(1 - K)$$
$$B = 255(1 - Y)(1 - K)$$

2. RGB-XYZ (для стандартного источника дневного света D65)
   XYZ-RGB

$$F(x) = \begin{cases} \left(\dfrac{x + 0.055}{1.055}\right)^{2.4}, & x \geq 0.04045 \\ \dfrac{x}{12.92}, & \textit{иначе} \end{cases}$$

$$Rn = F(R/255) \cdot 100$$
$$Gn = F(G/255) \cdot 100$$
$$Bn = F(B/255) \cdot 100$$

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} 0.412453 & 0.357580 & 0.180423 \\ 0.212671 & 0.715160 & 0.072169 \\ 0.019334 & 0.119193 & 0.950227 \end{pmatrix} \begin{pmatrix} Rn \\ Gn \\ Bn \end{pmatrix}$$

$$\begin{pmatrix} Rn \\ Gn \\ Bn \end{pmatrix} = \begin{pmatrix} 3.2406 & -1.5372 & -0.4986 \\ -0.9689 & 1.8758 & 0.0415 \\ 0.0557 & -0.2040 & 1.0570 \end{pmatrix} \begin{pmatrix} X/100 \\ Y/100 \\ Z/100 \end{pmatrix}$$

$$F(x) = \begin{cases} 1.055 \cdot x^{1/2.4} - 0.055, & x \geq 0.0031308 \\ 12.92 \cdot x, & \textit{иначе} \end{cases}$$

$$R = F(Rn) \cdot 255$$
$$G = F(Gn) \cdot 255$$
$$B = F(Bn) \cdot 255$$

3. XYZ-Lab
   Lab-XYZ

$$F(x) = \begin{cases} \sqrt[3]{x}, & x \geq 0.008856 \\ 7.787x + \dfrac{16}{116}, & \textit{иначе} \end{cases}$$

$$L = 116 \cdot F(Y/Y_w) - 16$$
$$a = 500 \cdot (F(X/X_w) - F(Y/Y_w))$$
$$b = 200 \cdot (F(Y/Y_w) - F(Z/Z_w))$$

$(X_w, Y_w, Z_w) = (95.047,\ 100,\ 108.883)$ – *координаты точки белого*

$$F(x)=\begin{cases} x^3, & x^3 \geq 0.008856 \\ (x-\frac{16}{116})/7.787, & \textit{иначе} \end{cases}$$

$$\begin{aligned} Y &= F((L+16)/116)\cdot X_w \\ X &= F(a/500+(L+16)/116)\cdot Y_w \\ Z &= F((L+16)/116-b/200)\cdot Z_w \end{aligned}$$

4. XYZ-Luv
   Luv-XYZ

$$\begin{aligned} u' &= 4X/(X+15Y+3Z) \\ v' &= 9Y/(X+15Y+3Z) \end{aligned}$$

$$\begin{aligned} u_w' &= 4X_w/(X_w+15Y_w+3Z_w) \\ v_w' &= 9Y_w/(X_w+15Y_w+3Z_w) \end{aligned}$$

$$F(x)=\begin{cases} \sqrt[3]{x}, & x \geq 0.008856 \\ 7.787x+\frac{16}{116}, & \textit{иначе} \end{cases}$$

$$\begin{aligned} L &= 116\cdot F(Y/Y_w)-16 \\ u &= 13\cdot L\cdot(u'-u_w') \\ v &= 13\cdot L\cdot(v'-v_w') \end{aligned}$$

$(X_w, Y_w, Z_w) = (95.047,\ 100,\ 108.883)$ – *координаты точки белого*

$$\begin{aligned} u' &= u/(13\cdot L)+u_w' \\ v' &= u/(13\cdot L)+v_w' \end{aligned}$$

$$\begin{aligned} u_w' &= 4X_w/(X_w+15Y_w+3Z_w) \\ v_w' &= 9Y_w/(X_w+15Y_w+3Z_w) \end{aligned}$$

$$\begin{aligned} Y &= F^{-1}((L+16)/116)Y_w \\ X &= -(9\cdot Y\cdot u')/((u'-4)\cdot v'-u'\cdot v') \\ Z &= (9\cdot Y-(15\cdot v'\cdot Y)-(v'\cdot X))/(3\cdot v') \end{aligned}$$

$$F(x)=\begin{cases} x^3, & x^3 \geq 0.008856 \\ (x-\frac{16}{116})/7.787, & \textit{иначе} \end{cases}$$