

Equations: colorimetric data transfer from LCH*_a (CIELAB) to nce* and olv*₃

Given: CIELAB data of any colour L^* , $C^*_{ab,a}$, $h_{ab,a}$ = LCH^*_a = $LAB^*LCH^*_a$ or L^* , a^* , b^*
CIELAB data L^* , $C^*_{ab,a}$, $h_{ab,a}$, a^* , b^* of eight basic colours $X = OYLCVMNW$

Aim: nce* and rgb device data olv*₃ of the given colour (in example M located between O and Y)

$$\begin{aligned} \text{CIELAB Hue angle of colour and maximum colour } M & \quad h_{ab,a} = h_{ab,a,M} \quad (0 \leq h_{ab,a} < 360) \quad (1) \\ \text{Relative device hue angle ratio of } M & \quad \alpha_{a,M} = [h_{ab,a,M} - h_{ab,a,O}] / [h_{ab,a,Y} - h_{ab,a,O}] \quad (2) \\ \text{CIELAB lightness of } M & \quad L^*_M = \alpha_{a,M} L^*_a Y + (1 - \alpha_{a,M}) L^*_{a,O} \quad (3) \\ \text{CIELAB red-green chroma of } M & \quad a^*_{a,M} = \alpha_{a,M} a^*_a Y + (1 - \alpha_{a,M}) a^*_{a,O} \quad (4) \\ \text{CIELAB yellow-blue chroma of } M & \quad b^*_{a,M} = \alpha_{a,M} b^*_a Y + (1 - \alpha_{a,M}) b^*_{a,O} \quad (5) \\ \text{radial CIELAB chroma of } M & \quad C^*_{ab,a,M} = [\alpha_{a,M}^2 L^{*2}_a + b^{*2}_{a,M}]^{1/2} \quad (6) \\ \text{relative lightness of the given colour} & \quad l^* = [L^* - L^*_N] / [L^*_W - L^*_N] \quad (7) \\ \text{relative chroma of the given colour} & \quad c^* = C^*_{ab,a} / C^*_{ab,a,M} \quad (8) \\ \text{relative triangle lightness of the given colour} & \quad l^* = l^* - [L^*_M - L^*_N] / [L^*_W - L^*_N] c^* + 0.5 c^* \quad (9) \\ \text{relative blackness of the given colour} & \quad n^* = 1 - l^* - 0.5 c^* \quad (10) \\ \text{relative whiteness of the given colour} & \quad w^* = 1 - n^* - c^* \quad (11) \\ \text{elementary hue angle of the given colour} & \quad e^* = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (12) \\ \text{relative olv*}_{3,M} \text{ data of } M & \quad o^*_{3,M} = \alpha_{a,M} o^*_{3,Y} + (1 - \alpha_{a,M}) o^*_{3,O} \quad (13) \\ & \quad l^*_{3,M} = \alpha_{a,M} l^*_{3,Y} + (1 - \alpha_{a,M}) l^*_{3,O} \quad (14) \\ & \quad v^*_{3,M} = \alpha_{a,M} v^*_{3,Y} + (1 - \alpha_{a,M}) v^*_{3,O} \quad (15) \\ \text{relative olv*}_3 \text{ data of the given colour} & \quad o^*_3 = w^* + c^* o^*_{3,M} \quad (16) \\ & \quad l^*_3 = w^* + c^* l^*_{3,M} \quad (17) \\ & \quad v^*_3 = w^* + c^* v^*_{3,M} \quad (18) \end{aligned}$$

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Equations: colorimetric data transfer from nce* to olv*₃ (rgb data) and LCH*_a

Given: nce* data (similar NCS) of any colour $nce^* = lab^*nce^*$ ($0 \leq n^* \leq 1$, $e^* \leq c^* \leq 1$)
adapted CIELAB data L^* , $C^*_{ab,a}$, $h_{ab,a}$, a^* , b^* of eight basic colours $X = OYLCVMNW$

Aim: rgb device data olv*₃ and LCH*_a of the given colour

$$\begin{aligned} \text{elementary hue number of a colour} & \quad e^* \quad (0 \leq e^* < 1) \quad (1) \\ \text{CIELAB hue angle of colour and maximum colour } M & \quad h_{ab,a} = \text{function} [e^*] \quad (\text{with table/equation}) \quad (2) \\ \text{relative whiteness of the given colour} & \quad w^* = 1 - n^* - c^* \quad (3) \\ \text{relative triangle lightness of the given colour} & \quad l^* = 1 - n^* - 0.5 c^* \quad (4) \\ \text{olv*}_{3,M} \text{ data of maximum colour } M & \quad o^*_{3,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (5) \\ & \quad l^*_{3,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (6) \\ & \quad v^*_{3,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (7) \\ \text{relative olv*}_3 \text{ data of the given colour} & \quad o^*_3 = w^* + c^* o^*_{3,M} \quad (8) \\ & \quad l^*_3 = w^* + c^* l^*_{3,M} \quad (9) \\ & \quad v^*_3 = w^* + c^* v^*_{3,M} \quad (10) \\ \text{adapted CIELAB } LCH^*_a \text{ data of maximum colour } M & \quad L^*_M = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (11) \\ & \quad C^*_{ab,a,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (12) \\ & \quad h_{ab,a,M} = h_{ab,a} \quad (13) \\ \text{relative lightness of maximum colour } M & \quad l^*_M = [L^*_M - L^*_N] / [L^*_W - L^*_N] \quad (14) \\ \text{relative lightness of the given colour} & \quad l^* = l^* + l^*_M c^* + 0.5 c^* \quad (15) \\ \text{adapted CIELAB } LCH^*_a \text{ data of the given colour} & \quad L^* = l^* [L^*_W - L^*_N] + L^*_N \quad (16) \\ & \quad C^*_{ab,a} = c^* C^*_{ab,a,M} \quad (17) \\ & \quad h_{ab,a} = h_{ab,a,M} \quad (18) \end{aligned}$$

ZE121-3

Equations: colorimetric data transfer from LCH*_a (CIELAB) to nce* and olv*₃

Given: adapted CIELAB data of any colour L^* , $C^*_{ab,a}$, $h_{ab,a}$ = LCH^*_a = $LAB^*LCH^*_a$
adapted CIELAB data L^* , $C^*_{ab,a}$, $h_{ab,a}$, a^* , b^* of eight basic colours $X = OYLCVMNW$

Aim: nce* and rgb device data olv*₃ of the given colour

$$\begin{aligned} \text{hue angle of the given colour and of } M & \quad h_{ab,a} = H^*_a \quad (1) \\ \text{CIELAB } LCH^*_a \text{ data of maximum colour } M & \quad L^*_M = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (2) \\ & \quad C^*_{ab,a,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (3) \\ & \quad h_{ab,a,M} = h_{ab,a} \quad (4) \\ \text{relative lightness of the given colour} & \quad l^* = [L^* - L^*_N] / [L^*_W - L^*_N] \quad (5) \\ \text{relative chroma of the given colour} & \quad c^* = C^*_{ab,a} / C^*_{ab,a,M} \quad (6) \\ \text{relative triangle lightness of the given colour} & \quad l^* = l^* - [L^*_M - L^*_N] / [L^*_W - L^*_N] c^* + 0.5 c^* \quad (7) \\ \text{relative blackness of the given colour} & \quad n^* = 1 - l^* - 0.5 c^* \quad (8) \\ \text{relative whiteness of the given colour} & \quad w^* = 1 - n^* - c^* \quad (9) \\ \text{elementary hue angle of the given colour} & \quad e^* = \text{function} [h_{ab,a}] \quad (\text{with table or equation}) \quad (10) \\ \text{relative olv*}_{3,M} \text{ data of maximum colour } M & \quad o^*_{3,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (11) \\ & \quad l^*_{3,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (12) \\ & \quad v^*_{3,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (13) \\ \text{relative olv*}_3 \text{ data of the given colour} & \quad o^*_3 = w^* + c^* o^*_{3,M} \quad (14) \\ & \quad l^*_3 = w^* + c^* l^*_{3,M} \quad (15) \\ & \quad v^*_3 = w^* + c^* v^*_{3,M} \quad (16) \end{aligned}$$

ZE120-7

Equations: colorimetric data transfer from olv*₃ to nce* data and LCH*_a data

Given: rgb device data of any colour $olv^*_3 = lab^*olv^*_3$
adapted CIELAB data L^* , $C^*_{ab,a}$, $h_{ab,a}$, a^* , b^* of eight basic colours $X = OYLCVMNW$

Aim: nce* = lab^*nce^* (similar to NCS data) and LCH*_a data of the given colour ($0 \leq n^* \leq 1$)

$$\begin{aligned} \text{relative chroma of the given colour} & \quad c^* = \max [olv^*_3] - \min [olv^*_3] \quad (1) \\ \text{relative blackness of the given colour} & \quad n^* = 1 - \max [olv^*_3] \quad (2) \\ \text{relative triangle lightness of the given colour} & \quad l^* = 1 - n^* - 0.5 c^* \quad (3) \\ \text{relative red-green chroma in 60 degree system } s & \quad \alpha_{ts} = o^*_3 \cos(30) + l^*_3 \cos(150) \quad (4) \\ \text{relative yellow-blue chroma in 60 degree system } s & \quad b^*_{ts} = o^*_3 \sin(30) + l^*_3 \sin(150) + v^*_3 \sin(270) \quad (5) \\ \text{hue angle in 60 degree system } s & \quad h_{ab,s} = \arctan [b^*_{ts} / \alpha_{ts}] \quad (0 \leq h_{ab,s} < 360) \quad (6) \\ \text{CIELAB hue angle in device system} & \quad h_{ab,a} = \text{function} [h_{ab,s}] \quad (\text{with table/equation}) \quad (7) \\ \text{elementary hue number of the given colour} & \quad e^* = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (8) \\ \text{adapted CIELAB } LCH^*_a \text{ data of maximum colour } M & \quad L^*_M = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (9) \\ & \quad C^*_{ab,a,M} = \text{function} [h_{ab,a}] \quad (\text{with table/equation}) \quad (10) \\ & \quad h_{ab,a,M} = h_{ab,a} \quad (11) \\ \text{relative lightness of maximum colour } M & \quad l^*_M = [L^*_M - L^*_N] / [L^*_W - L^*_N] \quad (12) \\ \text{relative lightness of the given colour} & \quad l^* = l^* + l^*_M c^* + 0.5 c^* \quad (13) \\ \text{adapted CIELAB } LCH^*_a \text{ data of the given colour} & \quad L^* = l^* [L^*_W - L^*_N] + L^*_N \quad (14) \\ & \quad C^*_{ab,a} = c^* C^*_{ab,a,M} \quad (15) \\ & \quad h_{ab,a} = h_{ab,a,M} \quad (16) \end{aligned}$$

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