Transformation between the *Judd* tristimulus and opponent values

Data see *K. Richter*, PhD thesis, University of Basel (Switzerland), 1969, page 81.

For the antagonistic spectral elementary colours
λ_B= 475 nm, λ_G= 502 nm, λ_Y= 574 nm, λ_R= 494c nm
the coordinates $\bar{x}_i$ (i=1 to 3) are used instead of modern coordinates $\bar{l}$, $\bar{a}$, $\bar{b}$.

Linear model equations between spectral colour values in both directions:

$$\begin{pmatrix}\bar{x}_1(\lambda)\\ \bar{x}_2(\lambda)\\ \bar{x}_3(\lambda)\end{pmatrix} = \begin{pmatrix}b_{11} & b_{12} & b_{13}\\ b_{21} & b_{22} & b_{23}\\ b_{31} & b_{32} & b_{33}\end{pmatrix} \cdot \begin{pmatrix}\bar{x}(\lambda)\\ \bar{y}(\lambda)\\ \bar{z}(\lambda)\end{pmatrix} = \begin{pmatrix}0{,}0000 & 1{,}0000 & 0{,}0000\\ 2{,}9797 & -2{,}6662 & -0{,}0960\\ -0{,}4139 & 1{,}4571 & -2{,}4046\end{pmatrix} \cdot \begin{pmatrix}\bar{x}(\lambda)\\ \bar{y}(\lambda)\\ \bar{z}(\lambda)\end{pmatrix} \qquad (1)$$

$$\begin{pmatrix}\bar{x}(\lambda)\\ \bar{y}(\lambda)\\ \bar{z}(\lambda)\end{pmatrix} = \begin{pmatrix}a_{11} & a_{12} & a_{13}\\ a_{21} & a_{22} & a_{23}\\ a_{31} & a_{32} & a_{33}\end{pmatrix} \cdot \begin{pmatrix}\bar{x}_1(\lambda)\\ \bar{x}_2(\lambda)\\ \bar{x}_3(\lambda)\end{pmatrix} = \begin{pmatrix}0{,}9093 & 0{,}3338 & -0{,}0133\\ 1{,}0000 & 0{,}0000 & 0{,}0000\\ 0{,}4494 & -0{,}0574 & -0{,}4136\end{pmatrix} \cdot \begin{pmatrix}\bar{x}_1(\lambda)\\ \bar{x}_2(\lambda)\\ \bar{x}_3(\lambda)\end{pmatrix} \qquad (2)$$

The tristimulus values X_1, X_2, X_3 and X, Y, Z need the same transformations.

The normalized purity data a_n and b_n are defined in LabMUN 1969 as follows:
$a_n = n_a a_u = n_a X_2/X_1 = n_a x_2/x_1$; $n_a = 2{,}8$ (3) $b_n = b_u = X_3/X_1 = x_3/x_1$ (4) $x_3 = 1 - x_2 - x_1$ (5)

The normalized purity data a_n and b_n are defined in LabMUN 1969 as follows:

$$\begin{aligned} a_n &= n_a[(b_{21}-b_{23})x+(b_{22}-b_{23})y+b_{23}]/y\\ &=2{,}8(3{,}0757x-2{,}5702y-0{,}0960)/y\\ &=(8{,}6119x-7{,}1965y-0{,}2688)/y \qquad (6)\end{aligned}$$

$$\begin{aligned} b_n &= [(b_{31}-b_{33})x+(b_{32}-b_{33})y+b_{33}]/y\\ &=(1{,}9906x+3{,}8617y-2{,}4046)/y \qquad (7)\end{aligned}$$