**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
$\lambda_B$= 475 nm, $\lambda_G$= 502 nm, $\lambda_Y$= 574 nm, $\lambda_R$= 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:

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

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

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

The unnormalized purity data $a_u$and $b_u$are defined in LabMUN 1969 as follows:

$a_u = X_2/X_1 = x_2/x_1$ (3) $\quad b_u = X_3/X_1 = x_3/x_1$ (4) $\quad x_3 = 1 - x_2 - x_1$ (5)

The unnormalized purity data $a_u$and $b_u$are defined in LabMUN 1969 as follows:

$$a_u = [(b_{21}-b_{23})x + (b_{22}-b_{23})y + b_{23}]/y$$
$$= (3{,}0757x - 2{,}5702y - 0{,}0960)/y \quad (6)$$

$$b_u = [(b_{31}-b_{33})x + (b_{32}-b_{33})y + b_{33}]/y$$
$$= (1{,}9906x + 3{,}8617y - 2{,}4046)/y \quad (7)$$