*Baltic Astronomy, vol.3, 158–167, 1994.*

# INTRINSIC COLOUR INDICES OF O- AND B-TYPE STARS IN THE VILNIUS PHOTOMETRIC SYSTEM

J. Sūdžius and V. Bobinas

*Vilnius University Observatory, Čiurlionio 29, Vilnius 2009, Lithuania*

Received September 14, 1993.

**Abstract.** A new version of the intrinsic colour indices in the Vilnius photometric system for stars of spectral types O6–B2 and luminosity classes I–V is presented.

**Key words:** techniques: photometric: Vilnius photometric system – stars: early type – stars: fundamental parameters: intrinsic colour indices

## 1. Introduction

Since the latest revision of intrinsic colour indices in the Vilnius photometric system (Straižys et al. 1982), the General Photometric Catalogue of Stars Observed in the Vilnius System has been published (Straižys and Kazlauskas 1993). It contains a number of newly observed OB stars with small reddening. The new data enabled us to derive more accurate than previously available intrinsic colour indices for spectral types O6–B2 and luminosity classes I–V.

## 2. Data

The main source of photometric data is the catalogue of Straižys and Kazlauskas (1993). Among other sources, it includes a number of original catalogues with observations of OB stars (Zdanavičius et al. 1969, Sūdžius et al. 1970, Sūdžius 1974, Kazlauskas 1993, Sūdžius and Bobinas 1992). MK spectral types were taken from the catalogue of Jaschek (1978). The $B-V$ colour indices were selected from the catalogue of Ochsenbein et al. (1979).

For our study we selected stars of spectral types from O5 to B2. The sample of stars was compiled on the basis of the following criteria:

1) a star has precise colour indices in the Vilnius system and the *UBV* system,

2) MK spectral type of a star is unambiguosly determined according to Jaschek (1978),

3) the spectrum of a star shows neither emission lines nor other peculiarities,

4) a star is located outside regions with the anomalous interstellar extinction law (e.g., Orion, Cygnus Rift and others),

5) a star is not component of a binary system,

6) a star is not heavily reddened by interstellar extinction ($E_{B-V} \leq 1$). (This restriction was not applied to supergiants.)

These conditions were fulfilled for 167 OB stars.

## 3. Method

Determination of intrinsic colour indices for O and early type B stars is complicated by the fact that those stars are relatively rare and distant objects and are usually located in the regions obscured by interstellar dust. However, the problem is simplified if values of a certain colour index and colour excess ratio are assumed to be known. We can safely make use of the intrinsic colour indices $(B-V)_0$ of the *UBV* system, since they are based on a large number of stars. Then an intrinsic colour index in the Vilnius system for a star may be calculated by the formula

$$(i-j)_0 = (i-j) - \frac{E_{i-j}}{E_{B-V}}[(B-V) - (B-V)_0], \qquad (1)$$

where $(i-j)$ is one of the six observed colour indices in the Vilnius system, $\frac{E_{i-j}}{E_{B-V}}$ is the colour excess ratio in the Vilnius system to that in the *UBV* system.

Since the number of stars of each MK spectral type was not large, we estimated errors of intrinsic colour indices theoretically. From (1) we get

$$\sigma_{ij_0} = \left[ \sigma_{ij}^2 + \left(\frac{E_{i-j}}{E_{B-V}}\right)^2 ( \sigma_{BV}^2 + \sigma_{BV_0}^2) + E_{B-V}^2 \, \sigma_{ijE}^2 \right]^{\frac{1}{2}}, \qquad (2)$$

where $\sigma_{ij}$ and $\sigma_{BV}$ are the errors of the corresponding colour indices, $\sigma_{BV_0}$ is the error of the intrinsic colour index $(B-V)_0$ and $\sigma_{ijE}$ is the error of the colour excess ratio.

The error of the intrinsic colour index $(B-V)_0$ is expressed by the relation

$$\sigma^2_{BV_0} = \sigma^2_{phBV_0} + \sigma^2_{spBV_0}, \tag{3}$$

where $\sigma_{phBV_0}$ is the photometric error and $\sigma_{spBV_0}$ is the error induced by spectral classification.

Photometric errors in the Vilnius system usually do not exceed $\pm 0.01$ mag. Photometric errors in $B-V$ are of the order of $\pm 0.015$ mag. We assumed this value to be the photometric error for all colour indices. According to Sūdžius (1974) and Kurilienė and Sūdžius (1974), errors of colour excess ratios are approximately equal to $\pm 0.005$. From the catalogue of MK spectra (Kennedy, 1983) we found that the error in spectral classification is about 0.65 of spectral subclass. This yields errors $\sigma_{spBV_0} = \pm 0.005$ and $\sigma_{spBV_0} = \pm 0.015$ for O-type and B-type stars, respectively. With the adopted values of errors we calculated errors of the intrinsic colour indices of individual stars. The obtained errors are in the range of $\pm 0.02$ to $\pm 0.03$.

For calculation of intrinsic colour indices of individual stars we used the $B-V$ colour indices from Ochsenbein et al. (1979) and the intrinsic $(B-V)_0$ colour indices from Straižys (1992). Colour excess ratios were taken from Kurilienė and Sūdžius (1974). To the obtained indices we ascribed weights inversely proportional to their squared errors. Then we derived the weighted means of intrinsic colour indices for a given MK spectral type. Slightly smoothed values of those means have been adopted as final intrinsic colour indices of the Vilnius system.

## 4. Results

The intrinsic colour indices for all 167 stars are given in Table 1. The adopted mean intrinsic colour indices in the Vilnius system are given in Tables 2–4. Errors of the weighted means of intrinsic colour indices for a given MK spectral type are presented in Table 5.

Comparison of our results with those of Kurilienė (1977) and Straižys et al. (1982) shows that there are no great discrepancies between the intrinsic colour indices.

**Table 1.** Intrinsic colour indices of individual stars in the Vilnius system

| HD/BD | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* | Sp | $E_{B-V}$ |
|---|---|---|---|---|---|---|---|---|
| 15629 | –0.03 | –0.02 | –0.06 | 0.01 | 0.00 | –0.03 | O5 V(f) | 0.76 |
| 14434 | –0.01 | –0.03 | 0.00 | –0.02 | 0.02 | 0.00 | O6.5 V | 0.49 |
| +60 501 | –0.02 | –0.02 | –0.05 | 0.00 | –0.02 | –0.01 | O6.5 V | 0.79 |
| 17505 | –0.02 | –0.01 | –0.03 | –0.01 | 0.00 | –0.05 | O6.5 V | 0.73 |
| 206267 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | O6.5 V | 0.52 |
| 12993 | 0.03 | 0.04 | –0.03 | 0.07 | 0.02 | 0.03 | O6.5 V | 0.42 |
| 47839 | 0.02 | 0.00 | 0.02 | 0.01 | 0.01 | 0.02 | O7 V | 0.07 |
| 48099 | –0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | O7 V | 0.27 |
| 18326 | –0.01 | 0.00 | –0.02 | –0.01 | 0.00 | –0.01 | O7 V | 0.69 |
| 217086 | 0.02 | –0.01 | –0.02 | –0.01 | 0.00 | 0.00 | O7 V | 0.95 |
| 168137 | –0.03 | –0.03 | –0.03 | 0.06 | –0.02 | 0.02 | O8 V | 0.71 |
| 169755 | 0.02 | –0.03 | –0.03 | 0.01 | –0.02 | 0.02 | O8 V | 0.85 |
| 216532 | 0.00 | 0.02 | –0.03 | 0.00 | –0.01 | –0.03 | O8 V | 0.87 |
| +60 470 | 0.00 | –0.01 | –0.01 | 0.00 | –0.04 | –0.04 | O8 V | 1.02 |
| 46966 | 0.00 | 0.02 | –0.01 | 0.00 | 0.01 | 0.01 | O8 V | 0.28 |
| 48279 | 0.02 | 0.03 | 0.04 | 0.02 | 0.01 | 0.03 | O8 V | 0.40 |
| 46056 | –0.01 | 0.02 | 0.00 | –0.01 | –0.01 | –0.04 | O8 V | 0.50 |
| 13268 | 0.00 | 0.00 | –0.01 | –0.02 | 0.02 | –0.02 | O8 V | 0.45 |
| 14633 | 0.01 | 0.00 | 0.02 | 0.00 | 0.02 | 0.01 | O8.5 V | 0.11 |
| 46149 | –0.01 | 0.01 | –0.01 | 0.00 | –0.01 | 0.01 | O8.5 V | 0.49 |
| 216532 | 0.04 | 0.02 | –0.03 | 0.01 | 0.01 | –0.04 | O8.5 V | 0.87 |
| 216898 | 0.00 | 0.01 | –0.01 | –0.01 | –0.01 | –0.03 | O8.5 V | 0.86 |
| +61 2559 | –0.01 | 0.03 | –0.01 | 0.04 | –0.03 | –0.03 | O9 V | 0.60 |
| +61 370 | 0.00 | –0.02 | –0.01 | 0.01 | –0.03 | –0.03 | O9 V | 1.01 |
| +60 594 | –0.01 | –0.01 | –0.03 | –0.01 | –0.01 | –0.02 | O9 V | 0.67 |
| 46202 | 0.02 | 0.05 | 0.00 | –0.01 | –0.00 | –0.01 | O9 V | 0.49 |
| 201345 | 0.01 | 0.03 | –0.01 | 0.01 | 0.00 | –0.00 | O9 V | 0.18 |
| 209481 | 0.02 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | O9 V | 0.37 |
| 235825 | –0.01 | 0.00 | –0.01 | 0.01 | 0.00 | 0.01 | O9 V | 0.55 |
| 214680 | –0.02 | 0.02 | 0.01 | 0.02 | –0.01 | 0.01 | O9 V | 0.11 |
| –13 4929 | 0.00 | –0.05 | –0.04 | 0.02 | –0.02 | 0.03 | O9.5 V | 0.95 |
| –13 4930 | 0.01 | –0.02 | –0.03 | 0.04 | –0.03 | 0.06 | O9.5 V | 0.61 |
| +60 498 | 0.00 | 0.04 | –0.03 | 0.02 | –0.02 | –0.02 | O9.5 V | 0.83 |
| 149757 | 0.01 | 0.05 | –0.01 | 0.05 | –0.02 | 0.03 | O9.5 V | 0.32 |
| 224257 | 0.02 | 0.07 | 0.02 | 0.03 | 0.00 | 0.02 | B0 IV | 0.24 |
| 217035 | 0.00 | 0.04 | –0.01 | –0.01 | 0.00 | –0.01 | B0 V | 0.76 |
| 217312 | 0.02 | 0.07 | 0.02 | 0.00 | –0.01 | 0.01 | B0 IV | 0.68 |

Table 1 (continued)

| HD/BD | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* | Sp | $E_{B-V}$ |
|---|---|---|---|---|---|---|---|---|
| 218342 | 0.02 | 0.05 | 0.01 | 0.01 | –0.03 | 0.01 | B0 IV | 0.72 |
| +59 497 | 0.00 | 0.02 | –0.02 | 0.02 | –0.03 | –0.01 | B0 V | 1.04 |
| 218376 | 0.05 | 0.09 | 0.01 | 0.03 | 0.01 | 0.02 | B0.5 IV | 0.25 |
| 8965 | 0.02 | 0.09 | 0.02 | 0.03 | 0.01 | 0.02 | B0.5 V | 0.31 |
| 202349 | 0.06 | 0.09 | 0.06 | 0.03 | 0.02 | 0.04 | B0.5 V | 0.09 |
| 216658 | 0.04 | 0.06 | 0.04 | –0.01 | 0.00 | 0.02 | B0.5 V | 0.98 |
| 217657 | 0.03 | 0.06 | 0.00 | 0.01 | –0.01 | –0.01 | B0.5 V | 0.78 |
| +57 2678 | 0.04 | 0.06 | 0.01 | 0.02 | –0.02 | 0.00 | B0.5 V | 0.76 |
| +58 2580 | 0.03 | 0.00 | 0.03 | 0.05 | –0.02 | 0.04 | B0.5 V | 1.06 |
| +59 456 | 0.05 | 0.06 | 0.02 | 0.01 | –0.01 | –0.02 | B0.5 V | 0.83 |
| 13544 | 0.08 | 0.08 | –0.03 | 0.04 | 0.03 | 0.00 | B0.5 IV | 0.28 |
| 185418 | 0.04 | 0.08 | –0.03 | 0.03 | 0.01 | –0.03 | B0.5 V | 0.51 |
| +35 4258 | 0.07 | 0.13 | 0.03 | 0.01 | 0.02 | 0.00 | B0.5 V n | 0.30 |
| +56 2930 | 0.07 | 0.10 | 0.04 | 0.03 | 0.02 | 0.03 | B1 IV | 0.63 |
| 3191 | 0.08 | 0.10 | 0.03 | 0.04 | 0.00 | 0.06 | B1 IV | 0.70 |
| 593 | 0.06 | 0.15 | 0.04 | 0.03 | 0.02 | 0.03 | B1 V | 0.28 |
| 7694 | 0.04 | 0.13 | 0.04 | 0.02 | 0.01 | 0.03 | B1 V | 0.16 |
| 188891 | 0.11 | 0.16 | 0.06 | 0.01 | 0.02 | 0.01 | B1 V | 0.25 |
| 201795 | 0.06 | 0.09 | 0.04 | 0.03 | 0.03 | 0.03 | B1 V | 0.23 |
| 202347 | 0.08 | 0.15 | 0.07 | 0.02 | 0.03 | 0.02 | B1 V | 0.17 |
| 213571 | 0.14 | 0.28 | 0.06 | 0.01 | 0.00 | 0.02 | B1 V | 0.23 |
| +61 2350 | 0.06 | 0.07 | 0.02 | 0.01 | 0.00 | –0.03 | B1 V | 1.00 |
| +61 2365 | 0.03 | 0.08 | 0.03 | 0.02 | 0.00 | 0.00 | B1 V | 0.78 |
| +61 2366 | 0.04 | 0.08 | 0.02 | 0.00 | 0.00 | –0.02 | B1 V | 1.00 |
| +62 2154 | 0.06 | 0.11 | 0.04 | 0.02 | 0.00 | –0.01 | B1 V | 0.77 |
| 216711 | 0.05 | 0.08 | 0.05 | 0.01 | –0.02 | 0.00 | B1 V | 0.89 |
| 217979 | 0.07 | 0.12 | 0.04 | 0.01 | –0.01 | 0.01 | B1 V | 0.62 |
| 218066 | 0.04 | 0.09 | 0.04 | 0.03 | –0.02 | 0.04 | B1 V | 0.66 |
| +62 2166 | 0.06 | 0.13 | 0.04 | 0.02 | 0.00 | 0.01 | B1 V | 0.74 |
| +58 453 | 0.07 | 0.10 | 0.04 | 0.02 | –0.01 | 0.00 | B1 V | 0.71 |
| 215191 | 0.10 | 0.16 | 0.06 | 0.03 | 0.02 | 0.02 | B1 V | 0.15 |
| 216092 | 0.13 | 0.20 | 0.04 | 0.03 | 0.02 | 0.01 | B1 V | 0.20 |
| 210478 | 0.08 | 0.13 | 0.04 | 0.02 | 0.02 | 0.01 | B1 V | 0.34 |
| 213976 | 0.09 | 0.19 | 0.05 | 0.03 | 0.02 | 0.02 | B1.5 V | 0.15 |
| 220057 | 0.13 | 0.27 | 0.09 | 0.03 | 0.02 | 0.03 | B2 IV | 0.27 |
| 220562 | 0.15 | 0.23 | 0.05 | 0.05 | 0.01 | 0.02 | B2 V | 0.50 |
| 829 | 0.18 | 0.26 | 0.05 | 0.04 | 0.02 | 0.03 | B2 V | 0.12 |

Table 1 (continued)

| HD/BD | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* | Sp | $E_{B-V}$ |
|---|---|---|---|---|---|---|---|---|
| +28 3438 | 0.12 | 0.18 | 0.07 | 0.05 | 0.01 | 0.04 | B2 IV | 0.25 |
| 209961 | 0.13 | 0.23 | 0.06 | 0.03 | 0.01 | 0.02 | B2 V sb | 0.19 |
| 212883 | 0.13 | 0.22 | 0.07 | 0.02 | 0.02 | 0.03 | B2 V | 0.12 |
| 212978 | 0.14 | 0.22 | 0.07 | 0.03 | 0.03 | 0.02 | B2 V | 0.11 |
| 213420 | 0.15 | 0.21 | 0.08 | 0.04 | 0.01 | 0.05 | B2 IV | 0.14 |
| 214167 | 0.08 | 0.19 | 0.08 | 0.03 | 0.02 | 0.03 | B2 V | 0.11 |
| 214263 | 0.11 | 0.21 | 0.06 | 0.03 | 0.02 | 0.03 | B2 V | 0.12 |
| 214652 | 0.12 | 0.23 | 0.08 | 0.04 | 0.03 | 0.04 | B2 V sb | 0.10 |
| 217101 | 0.10 | 0.20 | 0.07 | 0.04 | 0.01 | 0.03 | B2 V | 0.10 |
| 217227 | 0.17 | 0.31 | 0.07 | 0.03 | 0.01 | 0.02 | B2 V | 0.19 |
| 217811 | 0.17 | 0.27 | 0.06 | 0.03 | 0.00 | 0.01 | B2 V | 0.25 |
| 218344 | 0.13 | 0.24 | 0.07 | 0.03 | 0.01 | 0.02 | B2 V | 0.14 |
| 218407 | 0.13 | 0.23 | 0.07 | 0.03 | 0.01 | 0.02 | B2 V sb | 0.20 |
| 190864 | –0.01 | –0.01 | 0.02 | –0.01 | 0.00 | 0.05 | O7 III(f) | 0.50 |
| 186980 | 0.00 | –0.01 | 0.01 | 0.00 | 0.01 | 0.00 | O7.5 III | 0.39 |
| 203064 | 0.00 | 0.01 | –0.03 | 0.02 | 0.00 | 0.00 | O8 III | 0.30 |
| 1337 | 0.02 | 0.04 | 0.03 | 0.04 | 0.01 | 0.06 | O9 III | 0.14 |
| 218195 | –0.01 | 0.02 | –0.02 | 0.01 | 0.00 | 0.01 | O9 III | 0.58 |
| 16429 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | –0.03 | O9.5 III | 0.92 |
| 229234 | 0.07 | 0.08 | 0.01 | 0.02 | –0.04 | –0.01 | O9.5 III | 1.07 |
| 185780 | 0.04 | 0.06 | 0.02 | 0.00 | 0.01 | 0.02 | B0 III | 0.22 |
| 186994 | 0.04 | 0.06 | 0.02 | 0.01 | 0.03 | 0.02 | B0 III | 0.17 |
| 189957 | 0.04 | 0.05 | 0.07 | 0.04 | 0.04 | 0.08 | B0 III | 0.24 |
| 218323 | 0.05 | 0.03 | 0.01 | 0.00 | –0.03 | –0.03 | B0 III | 0.89 |
| +58 2549 | 0.03 | 0.05 | 0.02 | 0.00 | –0.02 | 0.00 | B0 III | 1.01 |
| 188439 | 0.09 | 0.09 | 0.05 | 0.03 | 0.03 | 0.05 | B0.5 III | 0.15 |
| 191531 | 0.03 | 0.06 | 0.00 | –0.02 | 0.00 | –0.02 | B0.5 III | 0.28 |
| 192445 | 0.09 | 0.15 | 0.07 | 0.01 | 0.02 | 0.19 | B0.5 III | 0.20 |
| 1544 | 0.02 | 0.05 | 0.01 | 0.04 | –0.01 | 0.02 | B0.5 III | 0.44 |
| 184915 | 0.01 | 0.04 | –0.01 | 0.03 | 0.00 | –0.01 | B0.5 III | 0.28 |
| 191139 | 0.04 | 0.06 | 0.04 | 0.00 | 0.00 | 0.06 | B0.5 III | 0.50 |
| 187879 | 0.12 | 0.14 | 0.05 | 0.02 | 0.03 | 0.04 | B1 III | 0.22 |
| +63 1962 | 0.04 | 0.10 | 0.05 | 0.03 | 0.00 | 0.01 | B1 III | 0.58 |
| +58 451 | 0.10 | 0.12 | 0.04 | 0.01 | –0.01 | 0.00 | B1 III | 0.78 |
| +59 510 | 0.06 | 0.07 | 0.03 | 0.04 | –0.03 | 0.02 | B1 III | 0.82 |
| 192303 | 0.04 | 0.18 | 0.01 | 0.04 | 0.00 | 0.02 | B1 III | 0.60 |
| 228602 | 0.06 | 0.17 | 0.05 | 0.04 | 0.00 |  | B1 III | 0.84 |

Table 1 (continued)

| HD/BD | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* | Sp | $E_{B-V}$ |
|---|---|---|---|---|---|---|---|---|
| +59 2719 | 0.08 | 0.13 | 0.04 | 0.02 | 0.03 | 0.04 | B2 III | 0.88 |
| 13590 | 0.18 | 0.19 | 0.06 | 0.03 | 0.00 | 0.12 | B2 III | 0.59 |
| 214993 | 0.10 | 0.13 | 0.05 | 0.04 | 0.02 | 0.04 | B2 III sb | 0.10 |
| 35468 | 0.16 | 0.22 | 0.05 | 0.04 | 0.05 | 0.05 | B2 III | 0.01 |
| 54439 | 0.09 | 0.11 | 0.06 | 0.06 | 0.00 | 0.03 | B2 III n | 0.28 |
| 189779 | 0.14 | 0.19 | 0.06 | 0.04 | 0.03 | 0.03 | B2 III | 0.34 |
| 24912 | 0.00 | −0.02 | 0.01 | 0.01 | −0.01 | 0.02 | O7.5 I | 0.32 |
| −11 4586 | 0.05 | −0.08 | −0.06 | 0.04 | −0.01 | 0.01 | O8 I | 1.32 |
| −12 4984 | 0.03 | −0.02 | −0.02 | 0.03 | 0.01 | 0.04 | O8 I | 1.10 |
| 17603 | 0.01 | −0.03 | −0.01 | −0.02 | 0.01 | −0.01 | O8.5 I(f) | 0.95 |
| 167330 | 0.02 | −0.07 | −0.08 | 0.04 | −0.01 | 0.00 | O9 I | 0.97 |
| 210809 | 0.02 | 0.02 | 0.03 | 0.02 | 0.00 | 0.07 | O9 Ib | 0.32 |
| 188209 | 0.02 | 0.02 | 0.03 | 0.02 | 0.01 | 0.07 | O9.5 Ia | 0.20 |
| 218915 | 0.04 | 0.02 | 0.03 | 0.04 | 0.01 | 0.07 | O9.5 Iab | 0.27 |
| +36 4063 | 0.03 | 0.04 | 0.02 | 0.03 | 0.01 | 0.04 | O9.5 Ib | 1.40 |
| 209975 | 0.02 | 0.02 | 0.04 | 0.03 | 0.02 | 0.06 | O9.5 Ib | 0.34 |
| 228779 | 0.07 | 0.04 | 0.05 | 0.01 | 0.01 | 0.03 | O9.5 Ib | 1.57 |
| 228534 | 0.06 | 0.10 | 0.06 | 0.01 | 0.01 | −0.01 | O9.5 II | 0.57 |
| 219287 | 0.04 | −0.01 | 0.02 | 0.03 | 0.01 | 0.07 | B0 Ia | 1.25 |
| +59 2735 | −0.02 | −0.05 | 0.03 | 0.04 | −0.02 | 0.04 | B0 Ib | 1.40 |
| 194280 | 0.05 | 0.06 | −0.01 | −0.01 | −0.01 | 0.01 | B0 Ib | 1.07 |
| 229238 | 0.12 | 0.12 | 0.06 | 0.04 | 0.00 | 0.03 | B0 I | 1.13 |
| +63 1964 | −0.01 | −0.04 | 0.03 | 0.03 | −0.04 | 0.01 | B0 II | 1.00 |
| 216044 | 0.02 | 0.03 | 0.02 | 0.03 | 0.02 | 0.00 | B0 II | 0.36 |
| +60 493 | 0.04 | −0.00 | 0.03 | 0.07 | 0.01 | 0.06 | B0.5 Ia | 1.00 |
| +63 1907 | 0.03 | −0.01 | 0.02 | −0.01 | −0.02 | 0.04 | B0.5 Ib | 1.15 |
| +58 2521 | 0.04 | 0.03 | 0.05 | 0.03 | 0.01 | 0.09 | B0.5 Ib | 1.01 |
| 194839 | 0.03 | 0.04 | 0.09 | 0.01 | 0.00 | 0.08 | B0.5 Ib | 1.21 |
| 13402 | 0.08 | 0.03 | 0.05 | 0.06 | 0.00 | 0.05 | B0.5 Ib | 0.80 |
| 201638 | 0.06 | 0.09 | 0.06 | 0.04 | 0.02 | 0.06 | B0.5 Ib | 0.08 |
| 192422 | 0.06 | 0.07 | 0.04 | 0.03 | 0.02 | 0.07 | B0.5 Ib | 0.71 |
| 228859 | 0.06 | 0.14 | 0.00 | 0.02 | 0.01 |  | B0.5 Ib | 1.06 |
| 213087 | 0.06 | 0.06 | 0.05 | 0.05 | 0.03 | 0.04 | B0.5 Ib | 0.58 |
| +8 4122 | 0.10 | 0.05 | 0.07 | 0.06 | 0.04 | 0.06 | B1 Ia | 0.44 |
| 2905 | 0.06 | 0.06 | 0.05 | 0.10 | 0.03 | 0.11 | B1 Ia | 0.33 |
| 13256 | 0.02 | −0.03 | 0.04 | 0.06 | −0.01 | 0.16 | B1 Ia | 1.38 |

Table 1 (continued)

| HD/BD | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* | Sp | $E_{B-V}$ |
|---|---|---|---|---|---|---|---|---|
| 216411 | 0.06 | 0.03 | 0.07 | 0.06 | 0.01 | 0.12 | B1 Ia | 0.79 |
| 15785 | 0.03 | 0.03 | 0.05 | 0.07 | 0.01 | 0.09 | B1 Iab | 0.68 |
| +48 3437 | 0.11 | 0.09 | 0.07 | 0.05 | 0.07 | 0.06 | B1 Iab | 0.35 |
| 13854 | 0.08 | 0.06 | 0.07 | 0.06 | 0.04 | 0.11 | B1 Iab | 0.47 |
| 194153 | 0.15 | 0.13 | 0.11 | 0.02 | 0.02 | 0.10 | B1 Iab | 1.25 |
| 194057 | 0.06 | 0.07 | 0.09 | 0.02 | 0.01 | 0.10 | B1 Ib | 1.06 |
| 40111 | 0.08 | 0.06 | 0.07 | 0.05 | 0.03 | 0.08 | B1 Ib | 0.14 |
| 52382 | 0.07 | 0.03 | 0.07 | 0.06 | 0.01 | 0.09 | B1 Ib | 0.41 |
| 91316 | 0.08 | 0.07 | 0.11 | 0.07 | 0.04 | 0.05 | B1 Ib | 0.06 |
| 190919 | 0.08 | 0.07 | 0.08 | 0.04 | 0.02 | 0.07 | B1 Ib | 0.45 |
| 191877 | 0.11 | 0.09 | 0.06 | 0.06 | 0.05 | 0.07 | B1 Ib | 0.18 |
| 227586 | 0.06 | 0.10 | 0.08 | 0.04 | 0.01 | 0.05 | B1 Ib | 0.41 |
| +59 451 | 0.09 | 0.07 | 0.06 | 0.03 | −0.02 | 0.01 | B1 II | 0.95 |
| 190603 | 0.08 | 0.04 | 0.11 | 0.06 | 0.02 | 0.13 | B2 Ia | 0.70 |
| 194279 | 0.09 | 0.09 | 0.10 | 0.04 | 0.02 | 0.13 | B2 Ia | 1.19 |
| 14818 | 0.13 | 0.05 | 0.11 | 0.06 | 0.04 | 0.10 | B2 Ia | 0.47 |
| 13841 | 0.12 | 0.09 | 0.09 | 0.06 | 0.06 | 0.08 | B2 Ib | 0.41 |
| 13866 | 0.14 | 0.12 | 0.08 | 0.06 | 0.04 | 0.05 | B2 Ib | 0.38 |
| 206165 | 0.16 | 0.12 | 0.08 | 0.06 | 0.03 | 0.06 | B2 Ib | 0.49 |
| +60 2553 | 0.10 | 0.13 | 0.05 | 0.03 | 0.02 | 0.05 | B2 II | 0.68 |

**Table 2.** Intrinsic colour indices for the main sequence

| Sp | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* |
|---|---|---|---|---|---|---|
| O6.5 | 0.00 | 0.00 | −0.02 | −0.01 | 0.00 | 0.00 |
| O7 | 0.00 | 0.00 | −0.02 | −0.01 | 0.00 | 0.00 |
| O7.5 | 0.00 | 0.00 | −0.02 | 0.00 | 0.00 | 0.00 |
| O8 | 0.00 | 0.00 | −0.02 | 0.00 | 0.00 | 0.00 |
| O8.5 | 0.00 | 0.01 | −0.01 | 0.00 | 0.00 | 0.00 |
| O9 | 0.00 | 0.01 | −0.01 | 0.01 | 0.00 | 0.00 |
| O9.5 | 0.00 | 0.02 | −0.01 | 0.01 | 0.00 | 0.01 |
| B0 | 0.01 | 0.05 | 0.00 | 0.01 | 0.00 | 0.01 |
| B0.5 | 0.04 | 0.07 | 0.02 | 0.02 | 0.00 | 0.01 |
| B1 | 0.06 | 0.10 | 0.04 | 0.02 | 0.00 | 0.02 |
| B1.5 | 0.09 | 0.15 | 0.05 | 0.03 | 0.01 | 0.02 |
| B2 | 0.13 | 0.22 | 0.06 | 0.03 | 0.02 | 0.03 |

**Table 3.** Intrinsic colour indices in the Vilnius system for giants

| Sp | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* |
|---|---|---|---|---|---|---|
| O7 | –0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| O7.5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| O8 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 |
| O8.5 | 0.01 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 |
| O9 | 0.01 | 0.03 | 0.01 | 0.01 | 0.00 | 0.01 |
| O9.5 | 0.02 | 0.04 | 0.01 | 0.01 | 0.00 | 0.01 |
| B0 | 0.03 | 0.05 | 0.02 | 0.01 | 0.00 | 0.01 |
| B0.5 | 0.04 | 0.06 | 0.02 | 0.02 | 0.00 | 0.01 |
| B1 | 0.07 | 0.12 | 0.03 | 0.03 | 0.00 | 0.01 |
| B1.5 | 0.10 | 0.14 | 0.04 | 0.04 | 0.01 | 0.02 |
| B2 | 0.12 | 0.17 | 0.06 | 0.04 | 0.02 | 0.03 |

**Table 4.** Intrinsic colour indices in the Vilnius system for supergiants

| Sp | *U–P* | *P–X* | *X–Y* | *Y–Z* | *Z–V* | *V–S* |
|---|---|---|---|---|---|---|
| O7.5 | 0.00 | –0.03 | –0.01 | 0.02 | 0.00 | 0.03 |
| O8 | 0.01 | –0.03 | –0.01 | 0.02 | 0.00 | 0.03 |
| O8.5 | 0.01 | –0.03 | 0.00 | 0.02 | 0.00 | 0.03 |
| O9 | 0.01 | –0.01 | 0.01 | 0.02 | 0.00 | 0.03 |
| O9.5 | 0.02 | 0.01 | 0.02 | 0.02 | 0.00 | 0.03 |
| B0 | 0.03 | 0.02 | 0.03 | 0.03 | 0.00 | 0.03 |
| B0.5 | 0.05 | 0.03 | 0.04 | 0.04 | 0.01 | 0.05 |
| B1 | 0.08 | 0.06 | 0.06 | 0.05 | 0.02 | 0.08 |
| B1.5 | 0.10 | 0.08 | 0.08 | 0.06 | 0.03 | 0.09 |
| B2 | 0.11 | 0.09 | 0.09 | 0.06 | 0.03 | 0.09 |

**Table 5.** Errors of intrinsic colour indices

| Sp | $\sigma_{UP_0}$ | $\sigma_{PX_0}$ | $\sigma_{XY_0}$ | $\sigma_{YZ_0}$ | $\sigma_{ZV_0}$ | $\sigma_{VS_0}$ |
|---|---|---|---|---|---|---|
| O7 – O9.5 V | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| B0 – B2 V | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| O7 – O9.5 III | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.03 |
| B0 – B2 III | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.02 |
| O I | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 |
| B I | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 |

## References

Jaschek M. 1978, CDS Inform. Bull., Strasbourg, No. 15, 121
Kazlauskas A., 1993, private communication
Kennedy P. M. 1983, MK Classification Catalogue (Magnetic Tape S3078), Strasbourg Stellar Data Center
Kurilienė G. 1977, Bull. Vilnius Obs., No. 44, 15
Kurilienė G., Sūdžius J. 1974, Bull. Vilnius Obs., No. 40, 10
Ochsenbein F., Bischoff M., Egret D. 1979, CDS Inform. Bull., No. 17, 88
Straižys V. 1992, Multicolor Stellar Photometry, Pachart Publ. House, Tucson, Arizona
Straižys V., Jodinskienė E., Kurilienė G. 1982, Bull. Vilnius Obs., No. 60, 16
Straižys V., Kazlauskas A. 1993, General Photometric Catalogue of Stars Observed in the Vilnius System, Baltic Astronomy, 2, 1
Sūdžius J. 1974, Bull. Vilnius Obs., No. 39, 11
Sūdžius J., Bobinas V. 1992, Bull. Vilnius Obs., No. 86, 59
Sūdžius J., Zdanavičius K., Sviderskienė Z., Straižys V., Bartkevičius A., Žitkevičius V., Kavaliauskaitė G., Kakaras G. 1970, Bull. Vilnius Obs., No. 29, 3
Zdanavičius K., Sūdžius J., Sviderskienė Z., Straižys V., Burnashov V., Drazdys R., Bartkevičius A., Kakaras G., Kavaliauskaitė G., Jasevičius V. 1969, Bull. Vilnius Obs., No. 26, 3