Corrigendum: 'Optical interconnections using microlens arrays'

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F. B. McCORMICK, F. A. P. TOOLEY, T. J. CLOONAN,
J. M. SASIAN, H. S. HINTON
AT&T Bell Laboratories, 200 Park Plaza, Naperville, IL 60566, USA
KEITH O. MERSEREAU, A. Y. FELDBLUM
AT&T Bell Laboratories, Princeton, NJ 08540, USA

In the above paper the argument of the exponential in Equation 7 should be negative. Equation 7 should read

$$w_0^{\text{eff}} = w_0[1 - e^{-x^2/2} \cos(px^2/4\pi)] \quad (7)$$

where

$$p = 2\pi z_1/2r \quad \text{and} \quad x = 2^{1/2}k \quad k > 1$$

The energy loss associated with a clipping ratio of $k = 2.12$ is about 0.01%, rather than 0.1%.

The tolerancing plots in Figs 10 and 11 contained some erroneous data points, and corrected plots are presented here in Figs 1 and 2, respectively. These figures display the percentage change in the output waist size (w_4), the output waist position (z_4) and the energy coupling into a $10\text{ }\mu\text{m}$ detector as the microlens system design parameters ($w_0, z_1, f_1, L, f_3, D_{\text{lens}1}$ and $D_{\text{lens}3}$) are individually varied over a $\pm 10\%$ range around their nominal values. The clipping ratio is $k = 2.12$ in Fig. 1 and $k = 1.517$ in Fig. 2. These plots show the percentage change as a function of all seven microlens system parameters (instead of only four of them, as was the case in the original paper). Additionally, the plots for each variable have been truncated at the points where the percentage change in the variable causes the clipping ratio at either lens to drop below $k = 1$. Below this point our expressions for the diffraction effects induced by clipping are no longer valid.

The new plots indicate that variations in the source-to-microlens spacing (z_1) or variations in the focal length of either microlens (f_1 or f_3) will affect the energy coupling within the system much more than variations in the other system parameters. The sensitivity to z_1 should not cause many system-level problems, because a 5% variation in z_1 will still permit more than 80% of the energy in the microlens beam to be coupled into the detector. A $\pm 5\%$ variation in z_1 is equivalent to a $\pm 45\text{ }\mu\text{m}$ displacement of the microlens array with respect to the source array, which is easily achievable with conventional mounting techniques. Although a 5% variation in either of the microlens focal lengths will still permit more than 80% of the energy to be coupled, the sensitivity to f_1 and f_3 is disturbing because of the relatively immature state of microlens fabrication and testing technology. Current

Figure 1 Tolerancing plots for clipping ratio $k = 2.12$: (a) w_4 , (b) z_4 and (c) energy coupling variation. (Figure 10 in original paper.)

Figure 2 Tolerancing plots for clipping ratio $k = 1.517$: (a) w_4 , (b) z_4 and (c) energy coupling variation. (Figure 11 in original paper.)

results that we have seen in refractive and volume holographic microlens arrays show focal length variations of 1 to 10% for the focal lengths and f -numbers required in this design. As improved testing techniques are developed, it is expected that the mechanisms leading to focal length variation will be identified and microlens arrays with focal length tolerances of $< 5\%$ will be achievable. Computer-generated diffractive microlenses offer almost no focal length variation, although (as discussed in the original paper) the theoretically low diffraction efficiencies (81%) of the $f/2$ to $f/3$ microlenses needed in this design may limit their application.

Comparisons between Figs 1 and 2 indicate that the energy coupling is closely related to the clipping ratio. As the clipping ratio is modified, the resultant change in the energy coupling as a function of variations in system parameters depends on the specific system parameter being varied, but significant changes in the sensitivities of z_1 , f_1 and f_3 are evident. For example, if the clipping ratio is decreased from 2.12 in Fig. 1 to 1.517 in Fig. 2 (indicating an increase in the amount of vignetted light from 0.01 to 1%), then the sensitivity of the energy coupling to variations in these three parameters is increased by approximately a factor of 1.5 to 2.0.

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