Errata

Fiber Tapering and Dimpling for Evanescent Coupling

Gregory van Beek

June 18, 2015

After an extra quality check and a calm read after the initial submission, I discovered some mistakes that are still present in the thesis. This errata should redress the following errors.

Page IV (Abstract):
'The diameter where the fiber becomes single mode is calculated to be around $1,2\pm0,30\mu$m.*'*
This diameter should be $(1,2\pm0,69)\,\mu$m as calculated on page 30 (chapter 4.3, Error analysis).

Page 7 (Evanescent wave):
Equation 2.8: $E = E_0 e^{i(k\cdot r-\omega t)}$.
In this equation, $k\cdot r$ should be the dot product of the wavenumber and the position $\overrightarrow{k}\cdot\overrightarrow{r}$. The dot product gives the direction of the plane wave in terms of (in this thesis) the y- and z-direction. This is especially important for the understanding of equation 2.14 and 2.15 where the two exponential functions are both representing one of the components of the transmitting wave shown in figure 2.4.
Equation 2.8 becomes therefore: $E = E_0 e^{i(\overrightarrow{k}\cdot\overrightarrow{r}-\omega t)}$.

Page 9 (Evanescent wave):
Equation 2.14 $E_t = E_{t0} e^{-\alpha y} e^{i\left(k_t \frac{\sin(\theta_j)}{\frac{n_2}{n_1}} x - \omega t\right)}$.
The second exponential function indicates the propagation of the light in the z-direction. That is why this should be in terms of z, and not in terms of x as it is written currently. This is just to prevent any confusion between the equation and the correct figure and explaination text below the equation.

This equation should become $E_t = E_{t0} e^{-\alpha y} e^{i\left(k_t \frac{\sin(\theta_j)}{\frac{n_2}{n_1}} z - \omega t\right)}$.

Page 9 (Evanescent wave):
Equation 2.15: $\alpha = \frac{2\pi n_2}{\lambda} \cdot \sqrt{\frac{n_1}{n_2}\sin(\theta_j) - 1}$.
This equation misses squares under the square root. The attenuation coefficient works in the y-direction, which is the cosine component of the transmitting wave. For the derivation with Snell's law, it is necessary to write this is terms of a sine, which can be done with the geometry rule $cos^2 = 1 - sin^2$.

This causes the equation to be squared, resulting in $\alpha = \frac{2\pi n_2}{\lambda} \cdot \sqrt{\left(\frac{n_1}{n_2}\right)^2 \sin^2(\theta_j) - 1}$.

Page 24 (transmission efficiency during pulling):
Equation 4.1: $L_{pull} = v \cdot (t_{pull} - t_{delay} - t_{post})$ *and equation 4.2:* $\frac{\Delta L_{pull}}{L_{pull}} = \frac{\Delta v}{v} + \frac{\Delta t}{t}$.
These equations, and also the calculated error in the pulling length on this page, uses L_{pull} as the variable for the pulling length. To prevent any confusion with the definition given in appendix A where L_{pull} is defined as $L_{pull} = 2x$, this should be changed in x.
So, this gives

$$x = v \cdot (t_{pull} - t_{delay} - t_{post})$$

for equation 4.1 and

$$\frac{\Delta x}{x} = \frac{\Delta v}{v} + \frac{\Delta t}{t}$$

for equation 4.2.
The calculated error in the discussed example is than $x = 0,16$mm. (Also the horizontal axis of figure 4.3 and figure 4.6 should be changed. The variable of the error calculated in the example given on page 30 (Error analysis) is correct).

Page 30 (Error analysis):
'The driving speed has a accuracy of $\Delta v = 0,5\mu m\ s^{-1}$*.'*
The driving speed of the stages has an accuracy of $\Delta v = 0,1\mu\text{m s}^{-1}$ what is also noted on page 24. In the example given on this page, the Δx becomes therefore 0,29 mm instead of 0,44 mm. The calculated error in the diameter ($\Delta d_1 = 0,69\mu$m) is still correct.
The errors of the diameter determined in the table B.1 of appendix B, which are determined with the described method on this page, are correctly calculated.

Page 38 (Tables):
t_{mm} *and* l_{pull} *header in table B.1 and table B.2.*
This should be $t_{pull} - t_{post}$ conform the definition given in figure 4.1 on page 24. The time that is shown in these columns is the time from the beginning of the measurements to the point where the fiber becomes single mode again. This is not clear from the current header of the column.
Also, the fourth column has l_{pull} in the header, which is actually the same as x used in the rest of the thesis (so $l_{pull} = x$). This can therefore be changed to the variable x to make this more clear.