Dreiecksnetze

Lösungen zu den Vorlesungsübungen

Übung: Fläche

$$a = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} \qquad \vec{v} = b - a = \begin{pmatrix} 4 \\ 0 \\ 0 \end{pmatrix}$$

$$b = \begin{pmatrix} 5 \\ 1 \\ 0 \end{pmatrix} \qquad \vec{w} = c - a = \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix}$$

$$c = \begin{pmatrix} 1 \\ 3 \\ 0 \end{pmatrix} \qquad A = \frac{1}{2} \left\| \begin{pmatrix} 0-0 \\ 0-0 \\ 8-0 \end{pmatrix} \right\| = \frac{1}{2} 8 = 4$$

Übung: Vertex-Normale

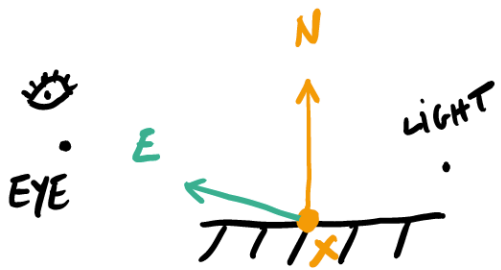
$$\begin{pmatrix}0.5\\1\\2\end{pmatrix}, \begin{pmatrix}1.5\\-0.5\\1\end{pmatrix}, \begin{pmatrix}1\\0.5\\2.5\end{pmatrix}, \begin{pmatrix}1\\-2.5\\1.5\end{pmatrix}, \begin{pmatrix}2\\1.5\\1\end{pmatrix}$$

$$\begin{pmatrix}6\\0\\8\end{pmatrix} = \begin{pmatrix}0.5\\1\\2\end{pmatrix} + \begin{pmatrix}1.5\\-0.5\\1\end{pmatrix} + \begin{pmatrix}1\\0.5\\2.5\end{pmatrix} + \begin{pmatrix}1\\-2.5\\1.5\end{pmatrix} + \begin{pmatrix}2\\1.5\\1\end{pmatrix}$$

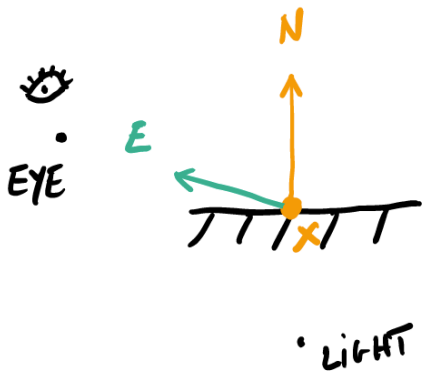
$$\left| \begin{pmatrix}6\\0\\8\end{pmatrix} \right| = \sqrt{6^2 + 0^2 + 8^2)} = \sqrt{36 + 0 + 64} = \sqrt{100} = 10$$

$$\vec{n} = \frac{1}{10}\begin{pmatrix}6\\0\\8\end{pmatrix} = \frac{1}{5}\begin{pmatrix}3\\0\\4\end{pmatrix}$$

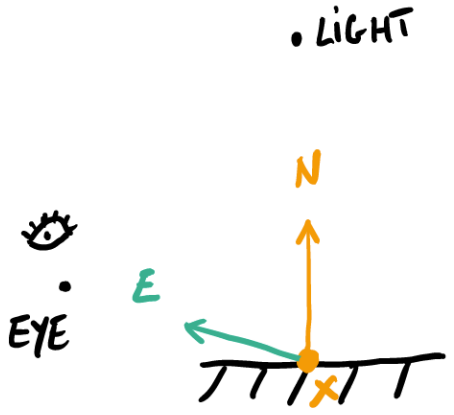
Übung: Beleuchtung



spekular



ambient



diffus

Übung: Texturkoordinaten

$$\alpha p + \beta q = x \Leftrightarrow \alpha \begin{pmatrix} 0 \\ 1 \end{pmatrix} + \beta \begin{pmatrix} 1 \\ 1 \end{pmatrix} = (u, v)$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \alpha \\ \beta \end{pmatrix} = \begin{pmatrix} 0.25 \\ 0.5 \end{pmatrix} \Rightarrow \begin{pmatrix} -1 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 0.25 \\ 0.5 \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix}$$

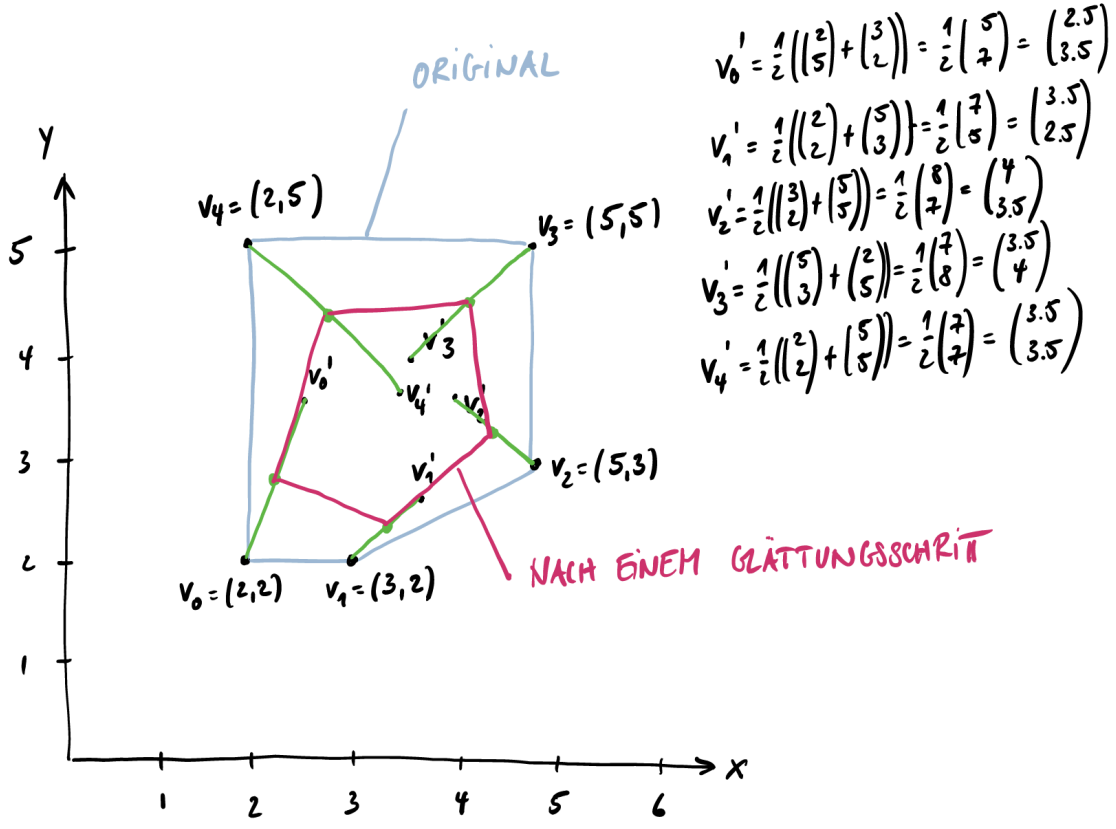
$$\begin{pmatrix} \alpha \\ \beta \end{pmatrix} = \begin{pmatrix} 0.25 \\ 0.25 \end{pmatrix}$$

$$(u, v) = \alpha \begin{pmatrix} 0 \\ 1 \end{pmatrix} + \beta \begin{pmatrix} 1 \\ 0 \end{pmatrix} = (0.25, 0.25)$$

Übung: Halbkantendatenstruktur

```
Set<Vertex> getAdjacent(Vertex v){
    Set<Vertex> verts = {}
    current = v.he
    DO
        current = current.opposite
        verts.add(current.v)
        current = current.next
    WHILE current != v.he
    return verts
}
```

Übung: Glättung



$$v_0' = \frac{1}{2}\left(\begin{pmatrix}2\\5\end{pmatrix} + \begin{pmatrix}3\\2\end{pmatrix}\right) = \frac{1}{2}\begin{pmatrix}5\\7\end{pmatrix} = \begin{pmatrix}2.5\\3.5\end{pmatrix}$$

$$v_1' = \frac{1}{2}\left(\begin{pmatrix}2\\2\end{pmatrix} + \begin{pmatrix}5\\3\end{pmatrix}\right) = \frac{1}{2}\begin{pmatrix}7\\5\end{pmatrix} = \begin{pmatrix}3.5\\2.5\end{pmatrix}$$

$$v_2' = \frac{1}{2}\left(\begin{pmatrix}3\\2\end{pmatrix} + \begin{pmatrix}5\\5\end{pmatrix}\right) = \frac{1}{2}\begin{pmatrix}8\\7\end{pmatrix} = \begin{pmatrix}4\\3.5\end{pmatrix}$$

$$v_3' = \frac{1}{2}\left(\begin{pmatrix}5\\3\end{pmatrix} + \begin{pmatrix}2\\5\end{pmatrix}\right) = \frac{1}{2}\begin{pmatrix}7\\8\end{pmatrix} = \begin{pmatrix}3.5\\4\end{pmatrix}$$

$$v_4' = \frac{1}{2}\left(\begin{pmatrix}2\\2\end{pmatrix} + \begin{pmatrix}5\\5\end{pmatrix}\right) = \frac{1}{2}\begin{pmatrix}7\\7\end{pmatrix} = \begin{pmatrix}3.5\\3.5\end{pmatrix}$$