HW1

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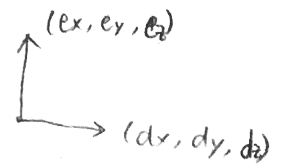
1. 1) We have proved in class that the vanishing point of a group of parallel line with direction (D_x, D_y, D_z) is

$$\left(\frac{fD_x}{D_z}, \frac{fD_y}{D_z}\right)$$

Now suppose (e_x, e_y, e_z) and (d_x, d_y, d_z) are the directions of two sets of parallel lines that are normal to each other, and they define a plane A



then the direction of any lines on plane A can be expressed as:

$$(ae_x + bd_x,\ ae_y + bd_y,\ ae_z + bd_z)$$

and the vanishing point for such direction is:

$$\left(\frac{f(ae_x + bd_x)}{ae_z + bd_z}, \frac{f(ae_y + bd_y)}{ae_z + bd_z}\right) \quad ①$$

$$= \left(\frac{ae_z}{ae_z + bd_z} \cdot \frac{fe_x}{e_z} + \frac{bd_z}{ae_z + bd_z} \cdot \frac{fd_x}{d_z},\ \frac{ae_z}{ae_z + bd_z} \cdot \frac{fe_y}{e_z} + \frac{bd_z}{ae_z + bd_z} \cdot \frac{fd_y}{d_z}\right)$$

$$= \frac{ae_z}{ae_z + bd_z}\left(\frac{fe_x}{e_z}, \frac{fe_y}{e_z}\right) + \frac{bd_z}{ae_z + bd_z}\left(\frac{fd_x}{d_z}, \frac{fd_y}{d_z}\right)$$

$\left(\frac{fe_x}{e_z}, \frac{fe_y}{e_z}\right)$ ② and $\left(\frac{fd_x}{d_z}, \frac{fd_y}{d_z}\right)$ ③ are vanishing points of (e_x, e_y, e_z) and (d_x, d_y, d_z), respectively.

then point ① is just on the same line as point ② and ③

This proves that any lines on the same plane have vanishing points on the same line, which is the vanishing line of the plane