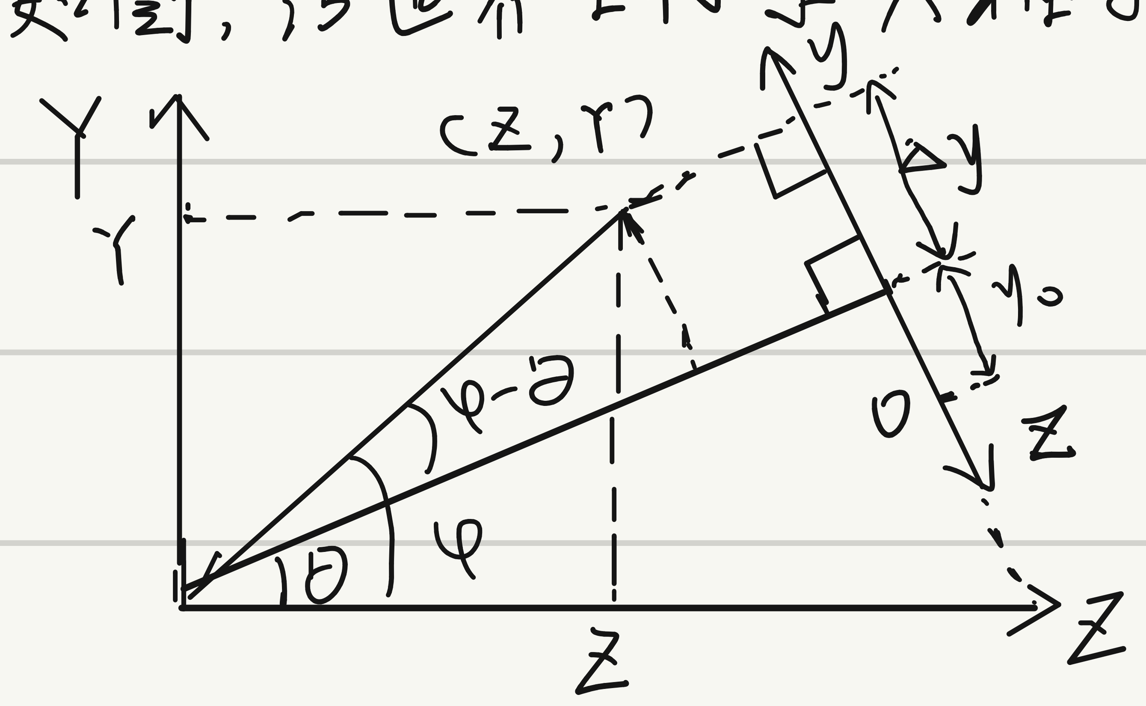
理论部分

3. 推导Fig. 1.5中从三维世界坐标系到图像平面的投影方程，要求详细步骤，而不是仅给出结果。

如图，沿世界坐标系 X 轴投影，可简化为如下二维平面



则 $\Delta y = \sqrt{Y^2+Z^2}\cdot\sin(\varphi-\theta)$

$= \sqrt{Y^2+Z^2}\sin\varphi\cos\theta - \sqrt{Y^2+Z^2}\cos\varphi\sin\theta$

而 $\sin\varphi = \frac{Y}{\sqrt{Y^2+Z^2}}$，$\cos\varphi = \frac{Z}{\sqrt{Y^2+Z^2}}$

$\therefore \Delta y = Y\cos\theta - Z\sin\theta$

考虑到因子 α，则 $y = \alpha\Delta y + y_0 = \alpha(Y\cos\theta - Z\sin\theta) + y_0$

而对于 $x = \alpha X + x_0$，因为 $\vec{x} \parallel \vec{X}$，故显然 $x = \alpha X + x_0$

4. 仿照关于Y的约束推导，写出关于Z的约束方程。

In a 3D horizontal edge, $\frac{\partial Z}{\partial y} = \frac{1}{\sin\theta}$

In a 3D vertical edge, $\frac{\partial Z}{\partial t} = n_x\frac{\partial Z}{\partial y} - n_y\frac{\partial Z}{\partial x} = 0$

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Constraint propagation:

For flat image region,
$$\begin{cases} \frac{\partial^2 Z}{\partial x^2} = 0 \\ \frac{\partial^2 Z}{\partial y^2} = 0 \\ \frac{\partial^2 Z}{\partial x \partial y} = 0 \end{cases}$$