共线条件方程

共线条件方程的一般形式

选取地面摄影测量坐标系与像空间辅助坐标系，并使两种坐标系的坐标轴彼此平行——

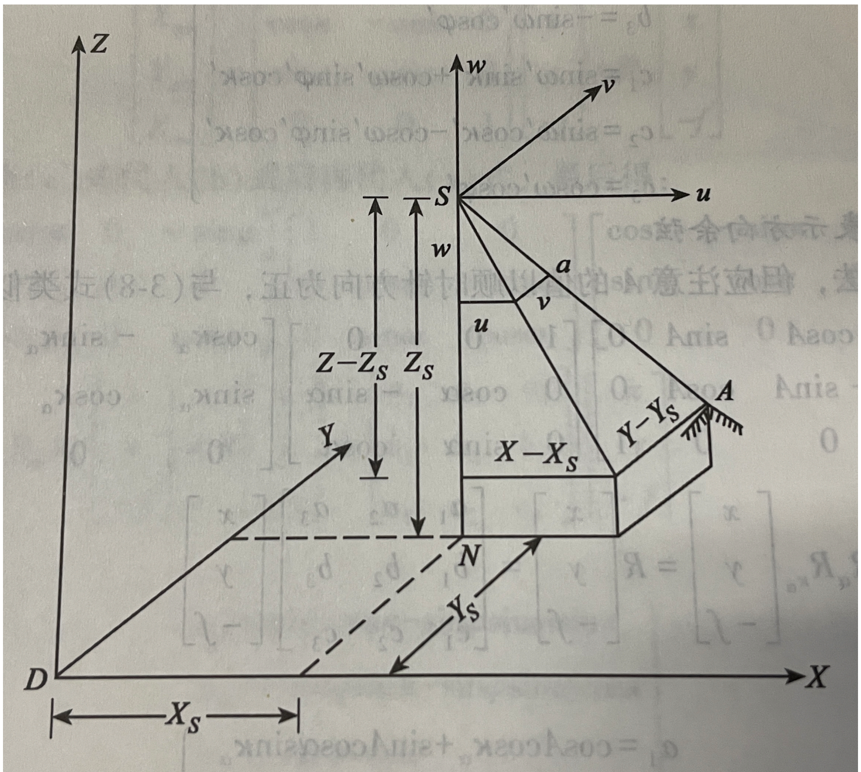

图 3-25 中心投影构像关系

由相似三角形的原理可知：

$$\frac{u}{X_A - X_S} = \frac{v}{Y_A - Y_S} = \frac{w}{Z_A - Z_S} = \frac{1}{\lambda}$$

其中，λ为比例因子。经过计算，我们能获得一个非线性的公式。

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \frac{1}{\lambda} \begin{bmatrix} X_A - X_s \\ Y_A - Y_s \\ Z_A - Z_s \end{bmatrix} \qquad \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \boldsymbol{R} \begin{bmatrix} x \\ y \\ -f \end{bmatrix} = \begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{bmatrix} \begin{bmatrix} x \\ y \\ -f \end{bmatrix}$$

$$x = -f \frac{a_1(X - X_s) + b_1(Y - Y_s) + c_1(Z - Z_s)}{a_3(X - X_s) + b_3(Y - Y_s) + c_3(Z - Z_s)}$$

$$y = -f \frac{a_2(X - X_s) + b_2(Y - Y_s) + c_2(Z - Z_s)}{a_3(X - X_s) + b_3(Y - Y_s) + c_3(Z - Z_s)}$$

共线条件方程的应用

- 求像底点坐标
- 单像空间后方交会和多像空间前方交会
- 摄影测量中的数字投影基础
- 航空影像模拟
- 光束法平差的基本数学模型
- 利用DEM制作数字正射影像图
- 利用DEM进行单张像片测图

共线条件方程的线性化

- 观测值：x, y
- 未知数：$X_S, Y_S, Z_S, \phi, \omega, \kappa, X, Y, Z, x_0, y_0, f$
- 泰勒级数展开

$$v_x = \frac{\partial x}{\partial \varphi}\Delta\varphi + \frac{\partial x}{\partial \omega}\Delta\omega + \frac{\partial x}{\partial \kappa}\Delta\kappa + \frac{\partial x}{\partial X_s}\Delta X_s + \frac{\partial x}{\partial Y_s}\Delta Y_s + \frac{\partial x}{\partial Z_s}\Delta Z_s + \frac{\partial x}{\partial X}\Delta X + \frac{\partial x}{\partial Y}\Delta Y + \frac{\partial x}{\partial Z}\Delta Z + \frac{\partial x}{\partial x_0}\Delta x_0 + \frac{\partial x}{\partial y_0}\Delta y_0 + \frac{\partial x}{\partial f}\Delta f + x^0 - x$$

$$v_y = \frac{\partial y}{\partial \varphi}\Delta\varphi + \frac{\partial y}{\partial \omega}\Delta\omega + \frac{\partial y}{\partial \kappa}\Delta\kappa + \frac{\partial y}{\partial X_s}\Delta X_s + \frac{\partial y}{\partial Y_s}\Delta Y_s + \frac{\partial y}{\partial Z_s}\Delta Z_s + \frac{\partial y}{\partial X}\Delta X + \frac{\partial y}{\partial Y}\Delta Y + \frac{\partial y}{\partial Z}\Delta Z + \frac{\partial y}{\partial x_0}\Delta x_0 + \frac{\partial y}{\partial y_0}\Delta y_0 + \frac{\partial y}{\partial f}\Delta f + y^0 - y$$