## 立体像对前方交会

# 定义

由立体像对中两张像片的内、外方位元素和像点坐标来确定相应地面点在物方空间坐标系中坐标的方法。

# 基本公式

- 共线方程线性化
  - 已知值：$x_0, y_0, f, m, X_s, Y_s, Z_s, \phi, \omega, \kappa$
  - 观测值：$x, y$
  - 未知数：$X, Y, Z$
  - 泰勒级数展开

$$v_x = \frac{\partial x}{\partial X_s}\Delta X + \frac{\partial x}{\partial Y_s}\Delta Y + \frac{\partial x}{\partial Z_s}\Delta Z + x^0 - x$$
$$v_y = \frac{\partial y}{\partial X_s}\Delta X + \frac{\partial y}{\partial Y_s}\Delta Y + \frac{\partial y}{\partial Z_s}\Delta Z + y^0 - y$$

- 共线方程
- 误差方程

$$v_x = a_{11}\Delta X + a_{12}\Delta Y + a_{13}\Delta Z + x^0 - x$$
$$v_y = a_{21}\Delta X + a_{22}\Delta Y + a_{23}\Delta Z + y^0 - y$$

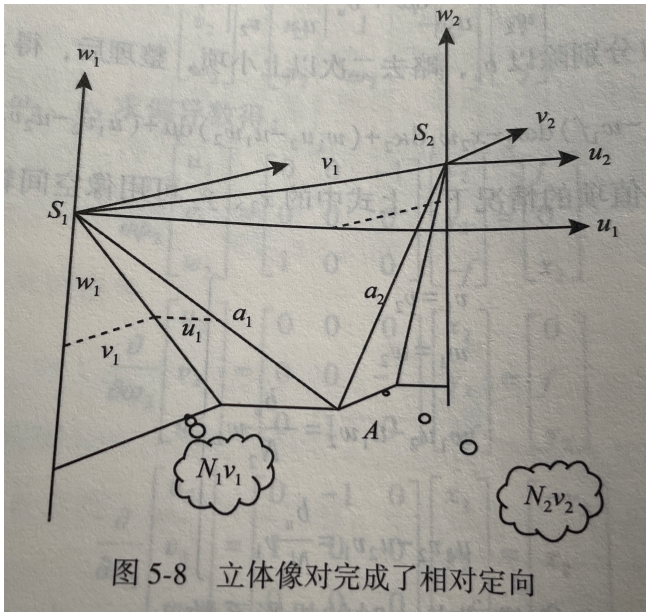


图 5-8　立体像对完成了相对定向

- 摄影基线

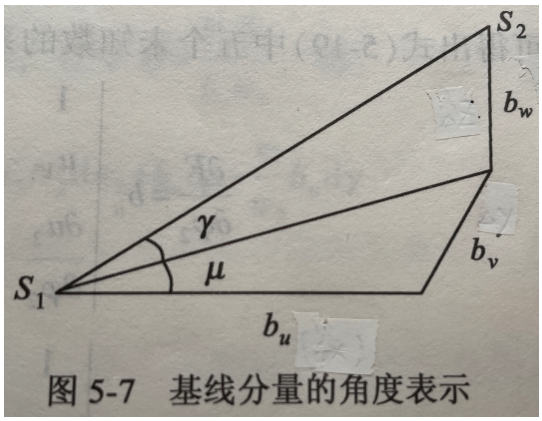
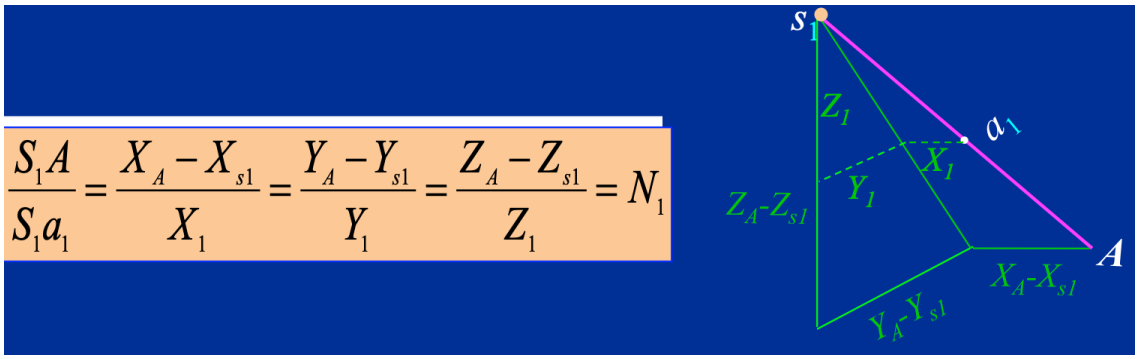


图 5-7　基线分量的角度表示

- 同名光线投影（以$a_1$点为例）




# 计算过程

1. 获取已知数据$x_0, y_0, f, X_{s1}, Y_{s1}, Z_{s1}, \phi_1, \omega_1, \kappa_1, X_{s2}, Y_{s2}, Z_{s2}, \phi_2, \omega_2, \kappa_2$
2. 量测像点坐标$x_1, y_1, x_2, y_2$
3. 由外方位线元素计算基线分量$B_x, B_y, B_z$
4. 由外方位角元素计算像空间辅助坐标$X_1, Y_1, Z_1, X_2, Y_2, Z_2$(需要旋转矩阵$R$)

$$B_X = X_{s2} - X_{s1} = N_1 X_1 - N_2 X_2$$
$$B_Y = Y_{s2} - Y_{s1} = N_1 Y_1 - N_2 Y_2$$
$$B_Z = Z_{s2} - Z_{s1} = N_1 Z_1 - N_2 Z_2$$

$$N_1 = \frac{B_X Z_2 - B_Z X_2}{X_1 Z_2 - X_2 Z_1}$$
$$N_2 = \frac{B_X Z_1 - B_Z X_1}{X_1 Z_2 - X_2 Z_1}$$

5. 计算投影系数$N_1, N_2$
6. 计算地面坐标$X_A, Y_A, Z_A$

# 利用立体像对确定地面点

- 共线条件严密解法
- 空间后方交会-空间前方交会解法