单片空间后方交会

定义

根据影像覆盖范围内一定数量的分布合理的地面控制点(已知其像点和地面点的坐标)，利用共线条件程求解像片外方位元素

误差方程和法方程

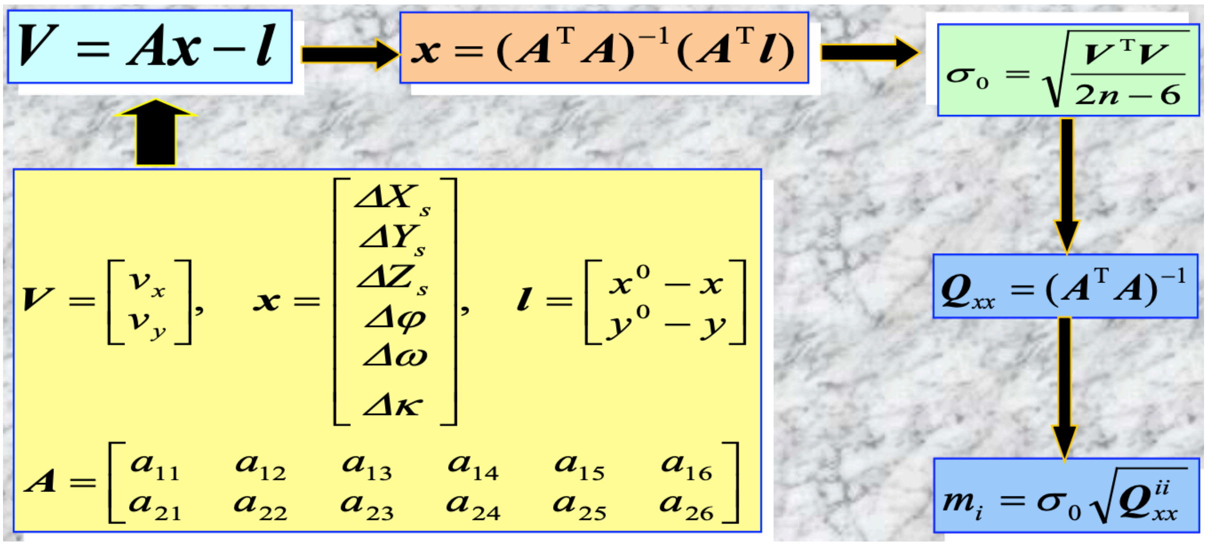
误差方程

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

$$v_x = \frac{\partial x}{\partial \varphi}\Delta\varphi + \frac{\partial x}{\partial \omega}\Delta\omega + \frac{\partial x}{\partial \kappa}\Delta\kappa + \frac{\partial x}{\partial X_s}\Delta X_s + \frac{\partial x}{\partial Y_s}\Delta Y_s + \frac{\partial x}{\partial Z_s}\Delta Z_s + x^0 - x$$

$$v_y = \frac{\partial y}{\partial \varphi}\Delta\varphi + \frac{\partial y}{\partial \omega}\Delta\omega + \frac{\partial y}{\partial \kappa}\Delta\kappa + \frac{\partial y}{\partial X_s}\Delta X_s + \frac{\partial y}{\partial Y_s}\Delta Y_s + \frac{\partial y}{\partial Z_s}\Delta Z_s + y^0 - y$$

计算过程



- 对于每一个控制点，我们都有这样的误差方程式：

$$v_x = \frac{\partial x}{\partial X_s}dX_s + \frac{\partial x}{\partial Y_s}dY_s + \frac{\partial x}{\partial Z_s}dZ_s + \frac{\partial x}{\partial \phi}d\phi + \frac{\partial x}{\partial \omega}d\omega + \frac{\partial x}{\partial \kappa}d\kappa + (x) - x$$
$$v_y = \frac{\partial y}{\partial X_s}dX_s + \frac{\partial y}{\partial Y_s}dY_s + \frac{\partial y}{\partial Z_s}dZ_s + \frac{\partial y}{\partial \phi}d\phi + \frac{\partial y}{\partial \omega}d\omega + \frac{\partial y}{\partial \kappa}d\kappa + (y) - y$$

- 上述外方位元素近似值改正数的系数可以用$a_{11}, a_{12}, ..., a_{26}$表示，则上式可以写成：

$$v_x = a_{11}dX_s + a_{12}dY_s + a_{13}dZ_s + a_{14}d\phi + a_{15}d\omega + a_{16}d\kappa - l_x$$
$$v_y = a_{21}dX_s + a_{22}dY_s + a_{23}dZ_s + a_{24}d\phi + a_{25}d\omega + a_{26}d\kappa - l_y$$

- 这样，我们就能将误差方程式用矩阵的方式写出（如图）。接着，外方位元素的解X就能求出
- 当外方位元素的改正数均小于某一限值的时候，迭代结束。
- 求A：首先用下式表示共线方程中的分母、分子

$$\overline{X} = a_1(X - X_s) + b_1(Y - Y_s) + c_1(Z - Z_s)$$
$$\overline{Y} = a_2(X - X_s) + b_2(Y - Y_s) + c_2(Z - Z_s)$$
$$\overline{Z} = a_3(X - X_s) + b_3(Y - Y_s) + c_3(Z - Z_s)$$

这样就可以方便地求偏导计算了（以a_{11}为例）

$$a_{11} = \frac{\partial x}{\partial X_s} = \frac{\partial(-f\frac{X}{Z})}{\partial X_s} = \frac{1}{Z}(a_1 f + a_3 x)$$

- 求L：以$l_x = x - (x)$为例，x是观测值，已知；(x)是计算得出的近似值，使用共线方程计算。