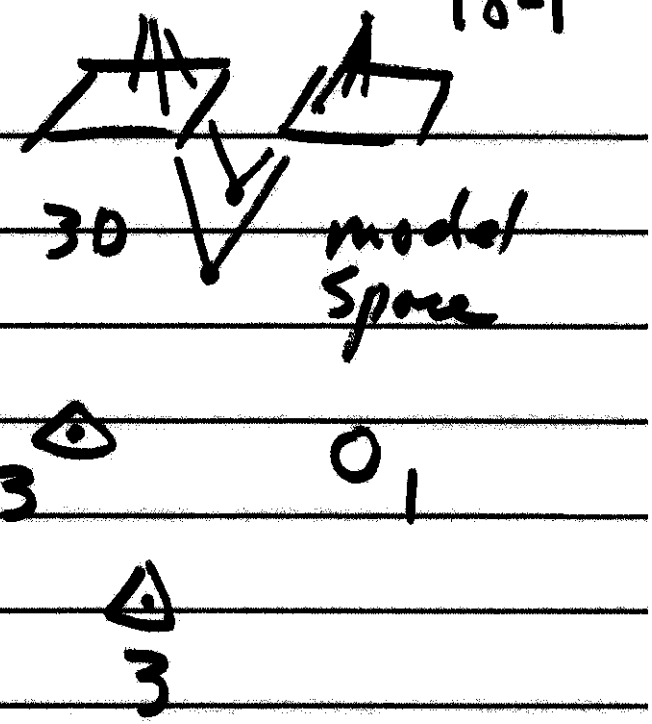
7-parameter transformation

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \lambda M \begin{pmatrix} x \\ y \\ z \end{pmatrix} + \begin{pmatrix} t_x \\ t_y \\ t_z \end{pmatrix}$$

Ref. Ground | model system



7 equations 7 unknowns

$\lambda, \omega, \varphi, \kappa, t_x, t_y, t_z$

5: Relative Or.
7: Absolute Or.
12

6: Left
6: Right
12

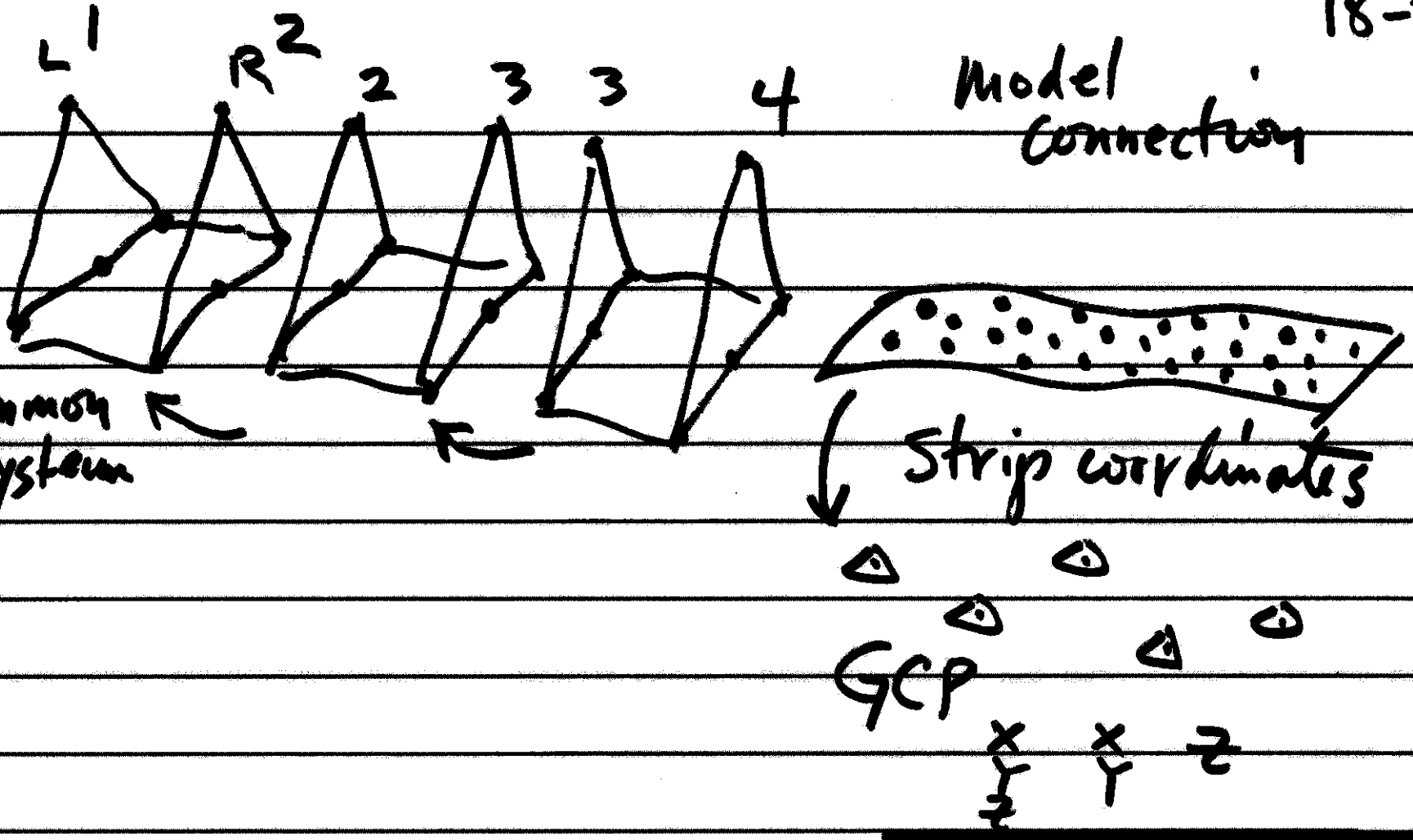
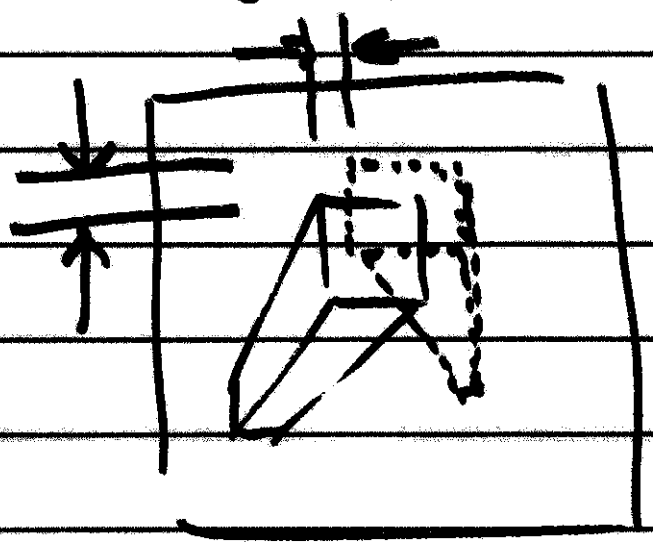

L 1
R 2
2
3
3
4
Model Connection
Common System
Strip coordinates
GCP
X
Y
Z

Image preparation { 1. Stereo Viewing
2. Matching



y-parallax

x-parallax

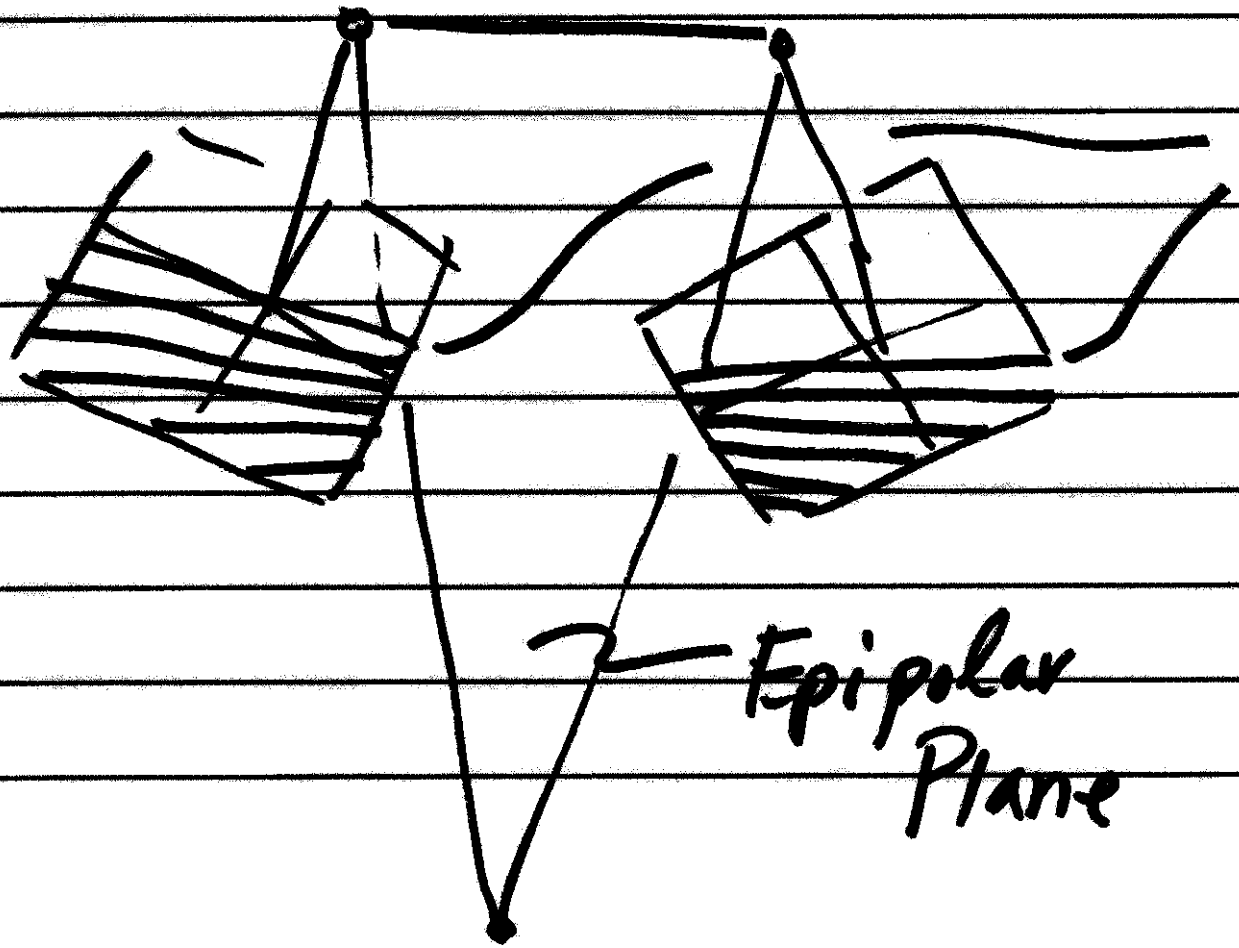
stereo ⇄ Matching

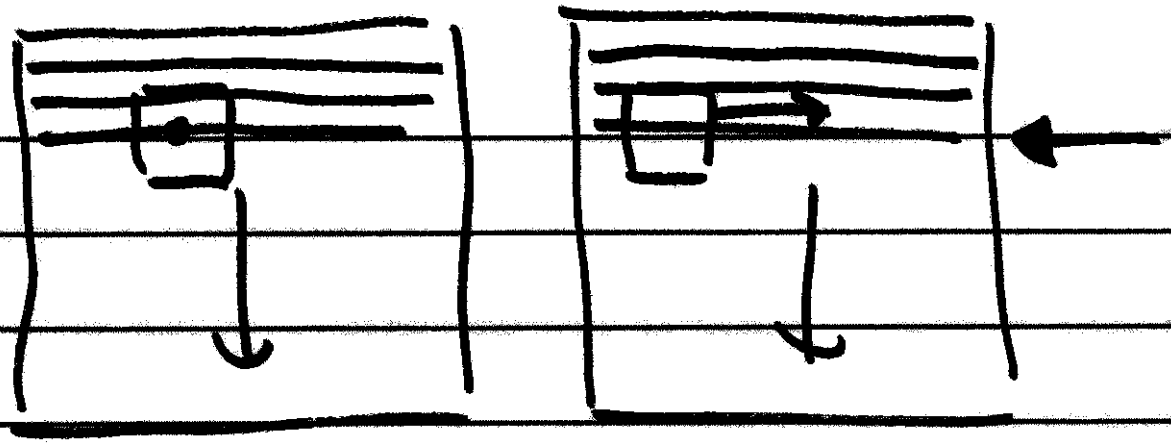
1. eliminate y-parallax
2. x-parallax ⇔ depth

Anaglyph
Optical
flicker
polarization

2 approaches:

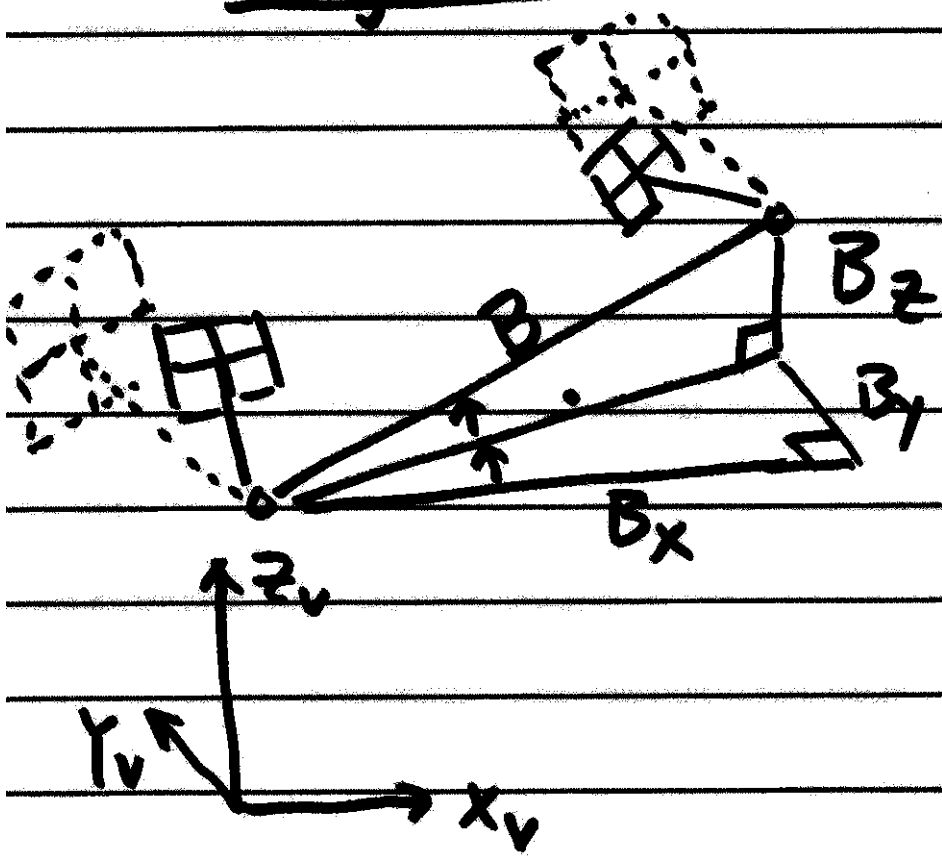
1. Epipolar resample
2. Image Normalization





Epipolar

Image Normalization ch.7



$$\cdot \sqrt{B_x^2 + B_y^2}$$

$$\theta_z : \tan^{-1} \frac{B_y}{B_x}$$

$$\theta_y : \tan^{-1} \frac{-B_z}{\sqrt{B_x^2 + B_y^2}}$$

$$\theta_x = \frac{\omega_1 + \omega_2}{2}$$

$$M_B = M_x(\theta_x) M_y(\theta_y) M_z(\theta_z)$$

$$\underline{X}_N = M_B \underline{X}_V$$

$$X_N = M_B X_V$$

$$X_P = M X_V \quad , \quad X_V = M^T X_P$$

$$X_N = M_B M^T X_P$$

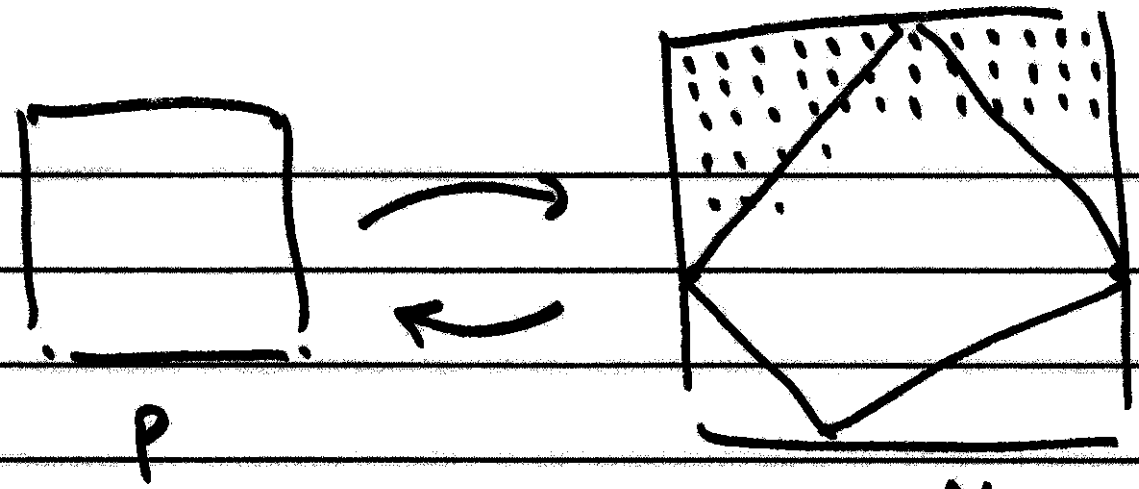
X_N = normalized image coords

X_P = photo image coords

$$\underbrace{M_{N_1}}$$

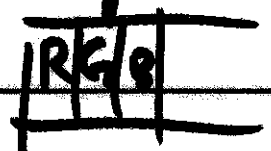
$$X_{N_1} = M_B M_1^T X_{P_1}$$

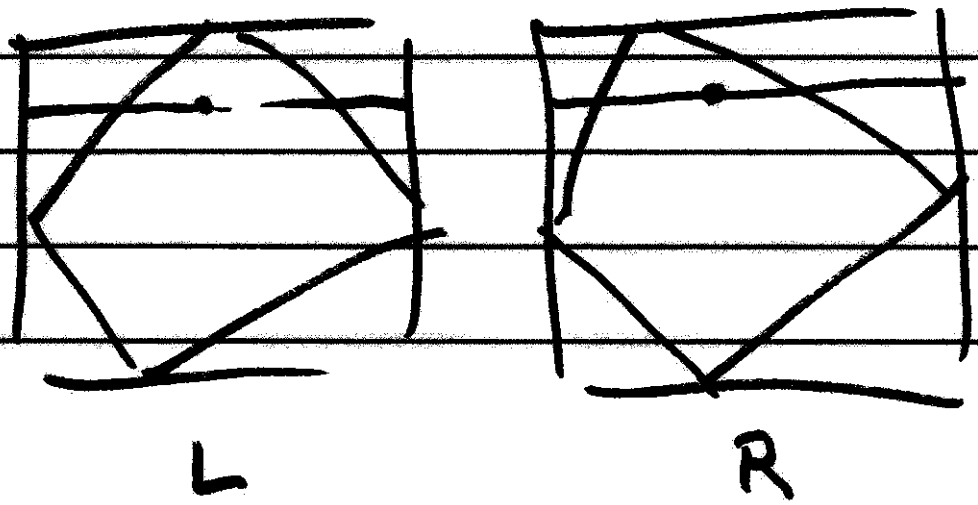
$$X_{N_2} = \underbrace{M_B M_2^T}_{M_{N_2}} X_{P_2}$$

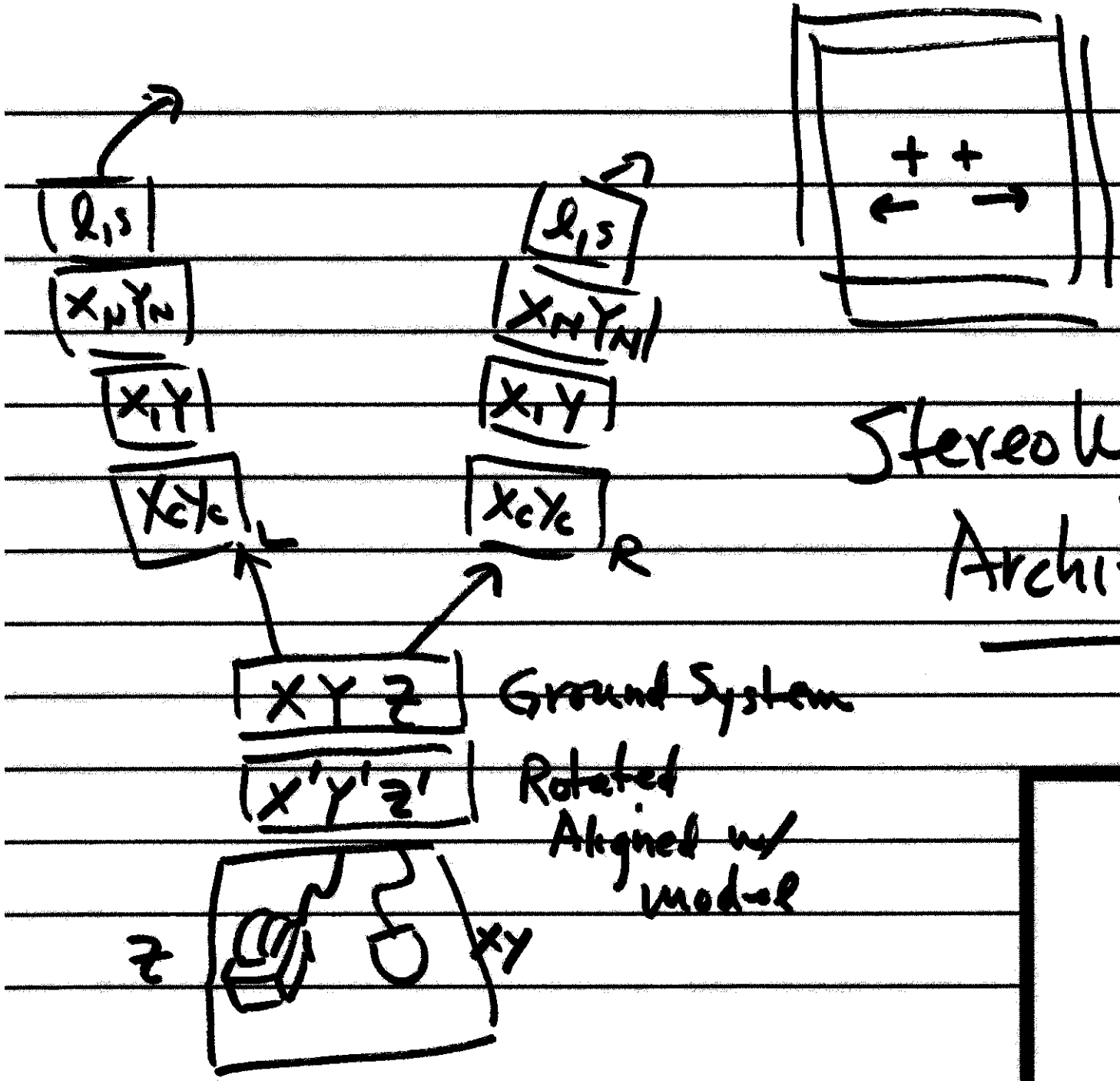


1. find limits

2. step through N, xform, interpolate in P






floating marks
Stereo Workstation Architecture
$l_{1,5}$
$X_N Y_N$
$X_1 Y_1$
$X_c Y_c$
L
$l_{1,5}$
$X_N Y_N$
$X_1 Y_1$
$X_c Y_c$
R
XYZ
Ground System
x'y'z'
Rotated Aligned w/ model
Z
XY

BAE Socet Set

Z/I ImageStation

Leica LPS, StereoAnalyst

Kork

Datem

Virtuozo

KLT

⋮

Stereo Workstation Vendors

Bundle, Intersection, Resection

7-parameter transf.

Estimation $\Delta = (B^T W B)^{-1} B^T W f$

Error Propagation : quality, repeatability of results