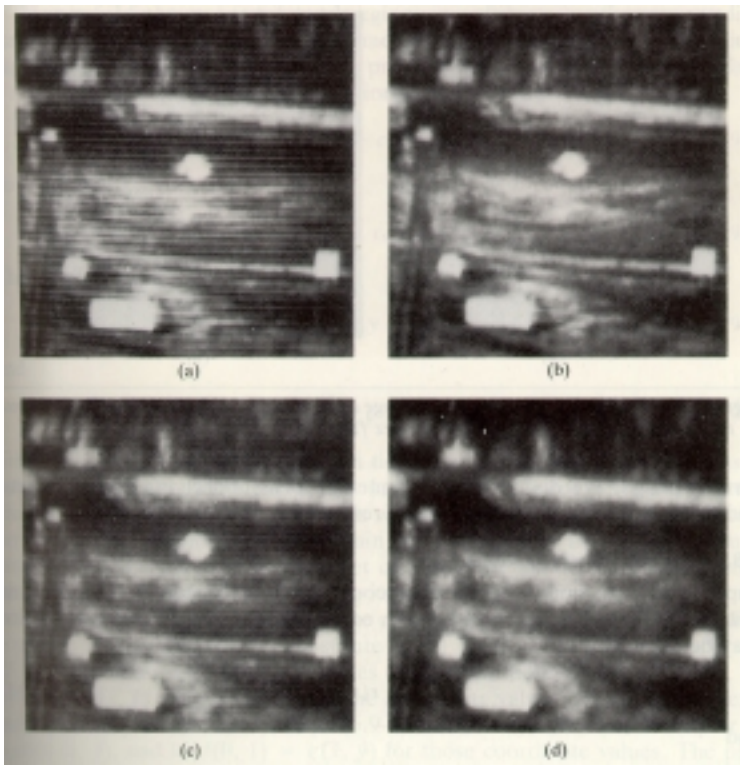
5.8 Restoration in Spatial Domain

- Coeffs. of convolution mask :

$$\hat{\mathbf{h}} = (\mathbf{C}^*\mathbf{C})^{-1}\mathbf{C}^*\mathbf{H} \qquad *: \text{conjugated transpose}$$

$$= \mathbf{C}^{\#}\mathbf{H}$$

Ex.)

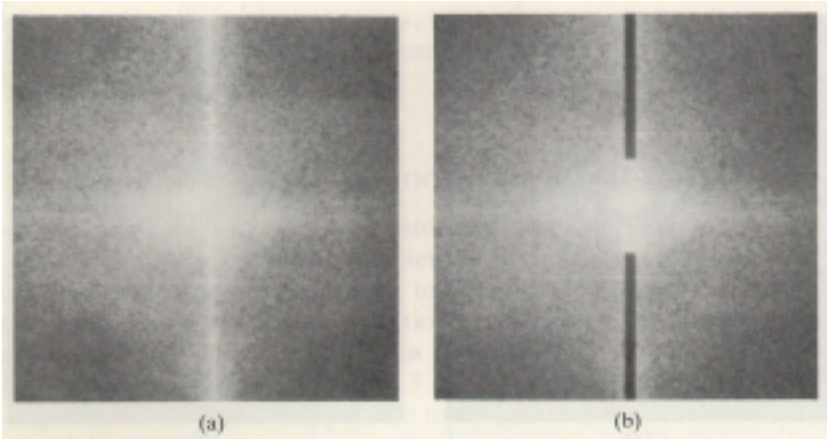


(a) infrared image corrupted by nearby periodic scanner interference (visible as ripple)
interference → produce burst of concentrated energy in the vertical axis of FT (fig. 13 (a))
notch filter fig. 5-13 (b)

(b) notch filtered images

(c) use of 9×9 convolution mast

(d) second pass of mask



5.9 Geometric Transformations

- modify the spatial relationship between pixels in image
  - (called rubber-sheet transformation)
  - two basic operation
    i. spatial transformation
    ii. gray-level interpolation

5.9.1 Spatial Transformations

- image f : pixel coordinates (x, y)
  g : geometric distortion with pixel coordinates $(\hat{x}, \hat{y})$

$$\hat{x} = r(x, y)$$
$$\hat{y} = s(x, y)$$

Spatial transformation

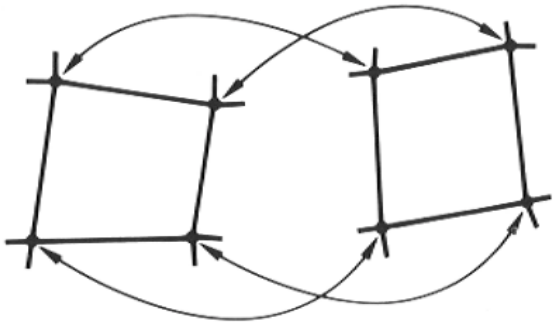
- spatially relocation of pixel
  tiepoints
  modeled by bilinear equations

$$r(x,y) = c_1x + c_2y + c_3xy + c_4$$
$$s(x,y) = c_5x + c_6y + c_7xy + c_8$$

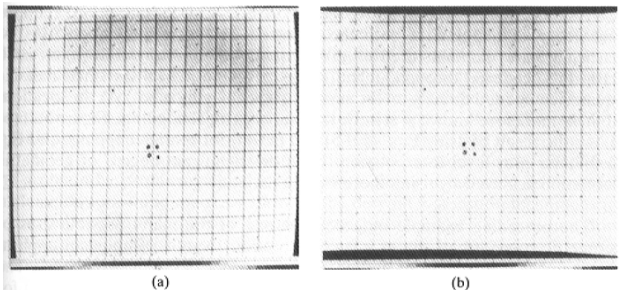
or

$$\hat{x} = c_1x + c_2y + c_3xy + c_4$$
$$\hat{y} = c_5x + c_6y + c_7xy + c_8$$

eight unknown value c_i ,i=1,8



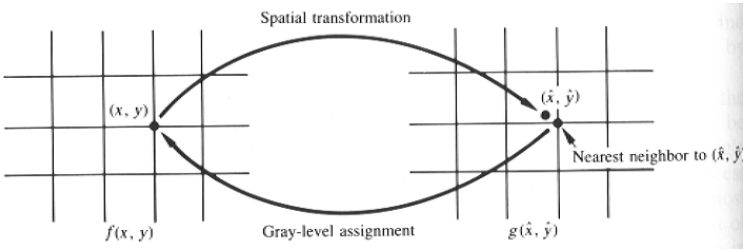
corresponding tiepoints



(a) geometrical distorted image (b) corrected image

5.9.2 Gray-level Interpolation

- Zero order interpolation



Nearst integer approach

- Bilinear interpolation

$$v(\hat{x},\hat{y}) = a\hat{x} + b\hat{y} + c\hat{x}\hat{y} + d$$

From 4 known neighbor of $(\hat{x},\hat{y})$, calculate unknown values of a,b,c,d
Finally one can obtaine $v(\hat{x},\hat{y})$