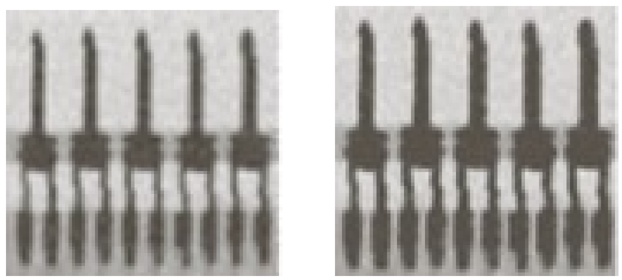
5.10 The two subimages shown were extracted from the top right corners of Figs. 5.7(c) and (d), respectively. Thus, the subimage on the left is the result of using an arithmetic mean filter of size 3×3; the other subimage is the result of using a geometric mean filter of the same size.

(a) Explain why the subimage obtained with geometric mean filtering is less blurred. Hint: Start your analysis by examining a 1-D step transition in intensity.

(b) Explain why the black components in the right image are thicker.



5.13 Obtain equations for the bandpass filters corresponding to the bandreject filters in Table 4.6.

5.17 During acquisition, an image undergoes uniform linear motion in the vertical direction for a time T1. The direction of motion then switches to the horizontal direction for a time interval T2. Assuming that the time it takes the image to change directions is negligible, and the shutter opening and closing times are negligible also, give an expression for the blurring function, H(u,v).

5.25 Cannon[1974] suggested a restoration filter R(u,v) satisfying the condition

$$|\hat{F}(u,v)|^2 = |R(u,v)|^2 |G(u,v)|^2$$

and based on the premise of forcing the power spectrum of the restored image, $|\hat{F}(u,v)|^2$, to equal the power spectrum of the original image, $|F(u,v)|^2$. Assume that the image and noise are uncorrelated.

(a) Find R(u,v) in terms of $|F(u,v)|^2$, $|H(u,v)|^2$, and $|N(u,v)|^2$. *Hint:* Refer to Fig. 5.1, Eq. 5.5-17, and Problem 5.24.

(b) Use your results in (a) to state a result in the form of Eq. 5.8-2.

5.29 Show that the Radon transform [Eq. 5.11-3] of the Gaussian shape $f(x,y) = A\exp(-x^2 - y^2)$ is $g(\rho,\theta) = A\sqrt{\pi}\exp(-\rho^2)$. *Hint:* Refer to Example 5.17, where we used symmetry to simplify integration). Use the Gaussian integral $\int_{-\infty}^{\infty} e^{-x^2}dx = \sqrt{\pi}$.