选择性滤波

一、带阻滤波器和带通滤波器

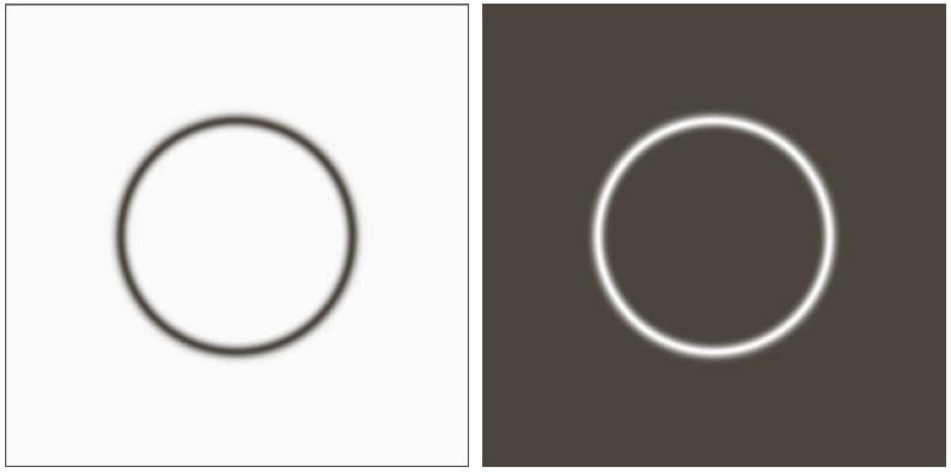
（1）带阻滤波器

TABLE 4.6
Bandreject filters. W is the width of the band, D is the distance $D(u, v)$ from the center of the filter, D_0 is the cutoff frequency, and n is the order of the Butterworth filter. We show D instead of $D(u, v)$ to simplify the notation in the table.

Ideal	Butterworth	Gaussian
$H(u,v) = \begin{cases} 0 & \text{if } D_0 - \frac{W}{2} \le D \le D_0 + \frac{W}{2} \\ 1 & \text{otherwise} \end{cases}$	$H(u,v) = \frac{1}{1 + \left[\frac{DW}{D^2 - D_0^2}\right]^{2n}}$	$H(u,v) = 1 - e^{-\left[\frac{D^2 - D_0^2}{DW}\right]^2}$

（2）带通滤波器

$$H_{BP}(u,v) = 1 - H_{BR}(u,v)$$



a b

FIGURE 4.63
(a) Bandreject Gaussian filter. (b) Corresponding bandpass filter. The thin black border in (a) was added for clarity; it is not part of the data.

二、陷波滤波器

（1）陷波滤波器原理

陷波滤波器是更有用的选择性滤波器，拒绝（或通过）事先定义的关于频率矩形中心的一个邻域的频率。零相移滤波器必须是关于原点对称的。

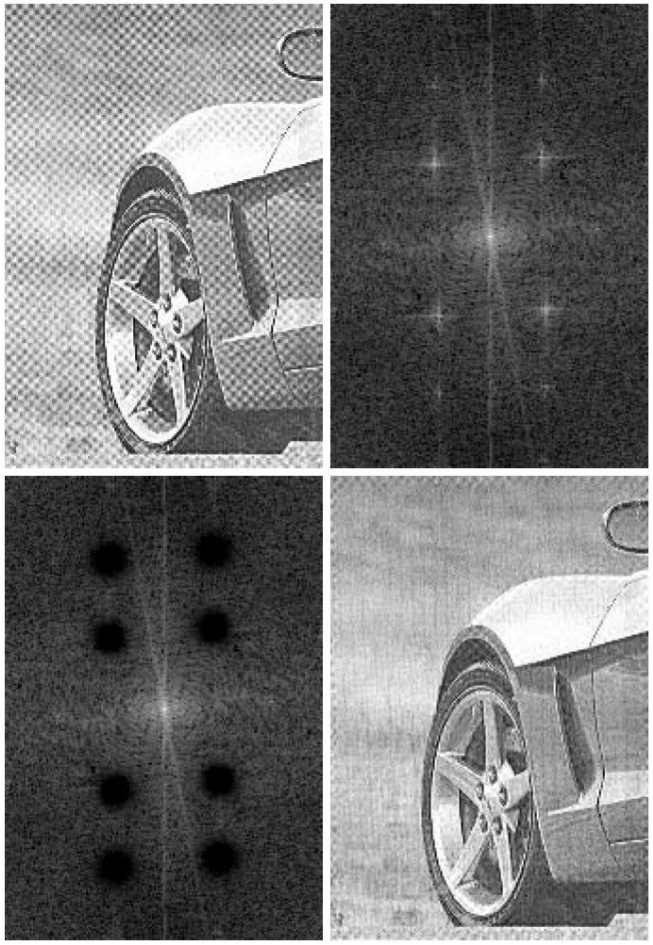
（2）陷波带阻滤波器

陷波带阻滤波器可以用已被平移到陷波滤波器中心的高通滤波器的乘积来构造。

$$H_{NR}(u,v)=\prod_{k=1}^{Q}H_k(u,v)H_{-k}(u,v)$$

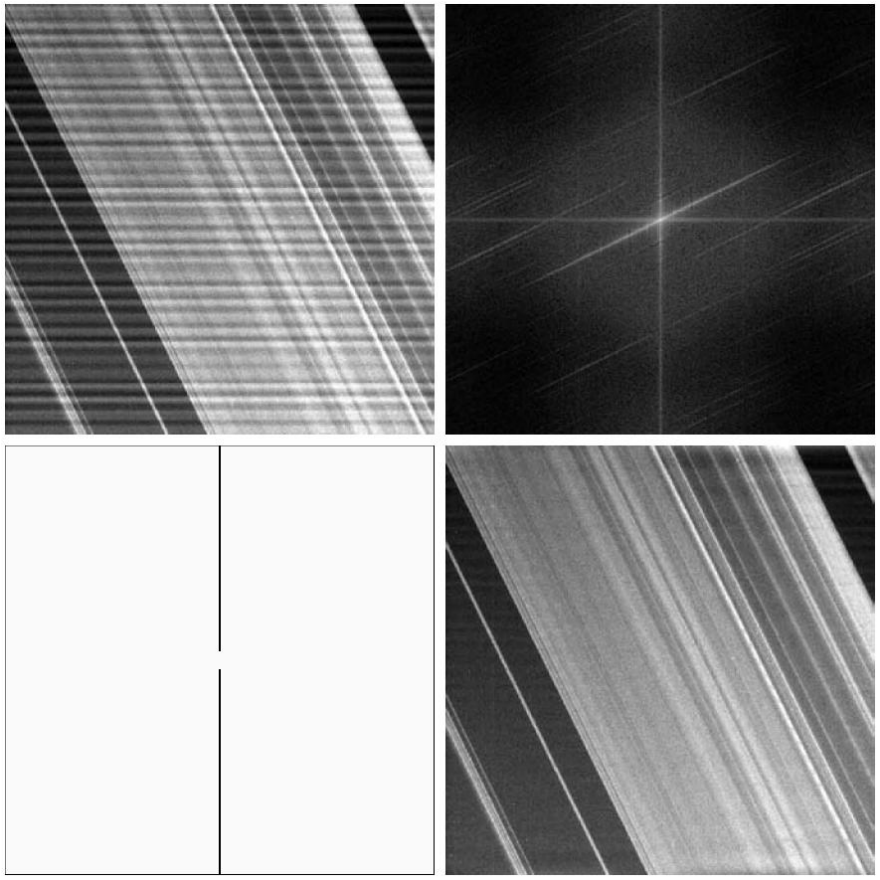
（3）陷波带通 滤波器

$$H_{NP}(u,v)=1-H_{NR}(u,v)$$



a b
c d

FIGURE 4.64
(a) Sampled newspaper image showing a moiré pattern. (b) Spectrum. (c) Butterworth notch reject filter multiplied by the Fourier transform. (d) Filtered image.



a b
c d

FIGURE 4.65
(a) 674 × 674 image of the Saturn rings showing nearly periodic interference. (b) Spectrum: The bursts of energy in the vertical axis near the origin correspond to the interference pattern. (c) A vertical notch reject filter. (d) Result of filtering. The thin black border in (c) was added for clarity; it is not part of the data. (Original image courtesy of Dr. Robert A. West, NASA/JPL.)

休 息 一 下