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课堂练习：将理想低通滤波器转化为巴特沃斯滤波器

```
clc,clf,clear all,close all;
f = imread('rice.png');
[M,N] = size(f);            % ¤'¢Q3h
figure,subplot(2,2,1),imshow(f),title('¤'¢Q');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
P = 2*M; Q = 2*N;
fp = zeros(P,Q);
fp(1:M,1:N) = f;
for i = 1:P
    for j = 1:Q
        fp(i,j) = fp(i,j).*(-1)^(i+j);
    end
end
Fp = fft2(fp);
D0 = 20;
Hp = zeros(P,Q);
for u = 1:P
    for v = 1:Q
        D = sqrt((u-P/2).^2+(v-Q/2).^2);
        if D <= D0
            Hp(u,v) =1./(1+(D/D0).^2);%n=1
        end
    end
end
Gp = Hp .* Fp;
gp = real(ifft2(Gp));
for i=1:P
    for j=1:Q
        gp(i,j) = gp(i,j).*(-1)^(i+j);
    end
end
gpi = gp(1:M, 1:N);
subplot(2,2,2),imshow(uint8(gpi)),title('D0=20');
%%%%%%%%%%%%%%%%%%%%%%%%%
D0 = 40;
Hp = zeros(P,Q);
for u = 1:P
    for v = 1:Q
        D = sqrt((u-P/2).^2+(v-Q/2).^2);
        if D <= D0
            Hp(u,v) =1./(1+(D/D0).^2);%n=1
        end
```

```
    end
end
Gp = Hp .* Fp;
gp = real(ifft2(Gp));
for i=1:P
    for j=1:Q
        gp(i,j) = gp(i,j).*(-1)^(i+j);
    end
end
gpi = gp(1:M, 1:N);
subplot(2,2,3),imshow(uint8(gpi)),title('D0=40');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
D0 = 60;
Hp = zeros(P,Q);
for u = 1:P
    for v = 1:Q
        D = sqrt((u-P/2).^2+(v-Q/2).^2);
        if D <= D0
            Hp(u,v) =1./(1+(D/D0).^2);%n=1
        end
    end
end
Gp = Hp .* Fp;
gp = real(ifft2(Gp));
for i=1:P
    for j=1:Q
        gp(i,j) = gp(i,j).*(-1)^(i+j);
    end
end
gpi = gp(1:M, 1:N);
subplot(2,2,4),imshow(uint8(gpi)),title('D0=60');
```

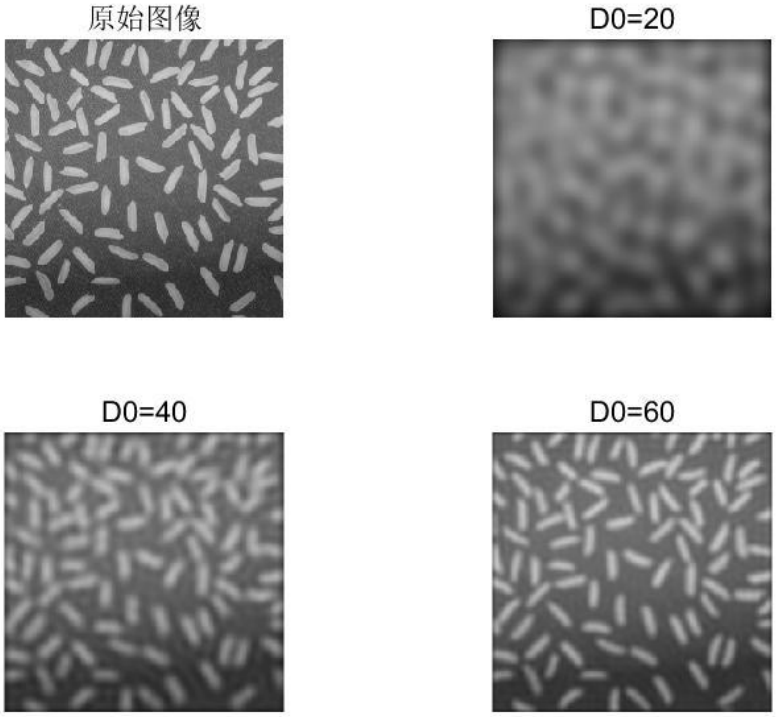
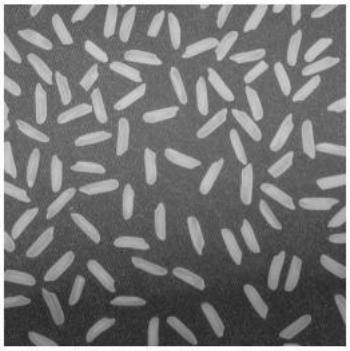


图 1

```
clc,clf,clear all,close all;
f = imread('rice.png');
[M,N] = size(f);              % ɀ'ɕϱӟɧ
imshow(f),title('ɀ'ɕϱ');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
P = 2*M; Q = 2*N;
fp = zeros(P,Q);
fp(1:M,1:N) = f;
for i = 1:P
    for j = 1:Q
        fp(i,j) = fp(i,j).*(-1)^(i+j);
    end
end
Fp = fft2(fp);
D0 = 20;
Hp = zeros(P,Q);
for u = 1:P
    for v = 1:Q
        D = sqrt((u-P/2).^2+(v-Q/2).^2);
        if D <= D0
            Hp(u,v) =1./(1+(D/D0).^2);%n=1
        end
    end
end
Gp = Hp .* Fp;
gp = real(ifft2(Gp));
for i=1:P
    for j=1:Q
        gp(i,j) = gp(i,j).*(-1)^(i+j);
    end
end
gpi = gp(1:M, 1:N);
figure,imshow(uint8(gpi)),title('D0=20');
```

原始图像



D0=20