Final Exam

1. Image processing

(1) Show the original image `lenna.tif`.

In [1]:

```
rgb = imread('lenna.tif');
rgb = im2double(rgb);
% rgb = tofloat(rgb); % also right
imshow(rgb);
```

(2) Display three components of RGB in one figure.

In [2]:

```
fr = rgb(:, :, 1);
fg = rgb(:, :, 2);
fb = rgb(:, :, 3);
figure
subplot(131), imshow(fr), title('Red');
subplot(132), imshow(fg), title('Green');
subplot(133), imshow(fb), title('Blue');
```

Display three components of HSI in one figure.

In [3]:

```
hsi = rgb2hsi(rgb);
fh = hsi(:, :, 1);
fs = hsi(:, :, 2);
fi = hsi(:, :, 3);
figure
subplot(131), imshow(fh), title('Hue');
subplot(132), imshow(fs), title('Saturation');
subplot(133), imshow(fi), title('Intensity');
```

(3) Smooth each component image of the RGB image independently using a 5×5 spatial averaging mask, and combine the individually smoothed images to form the smoothed, full-color RGB result. Show the result.

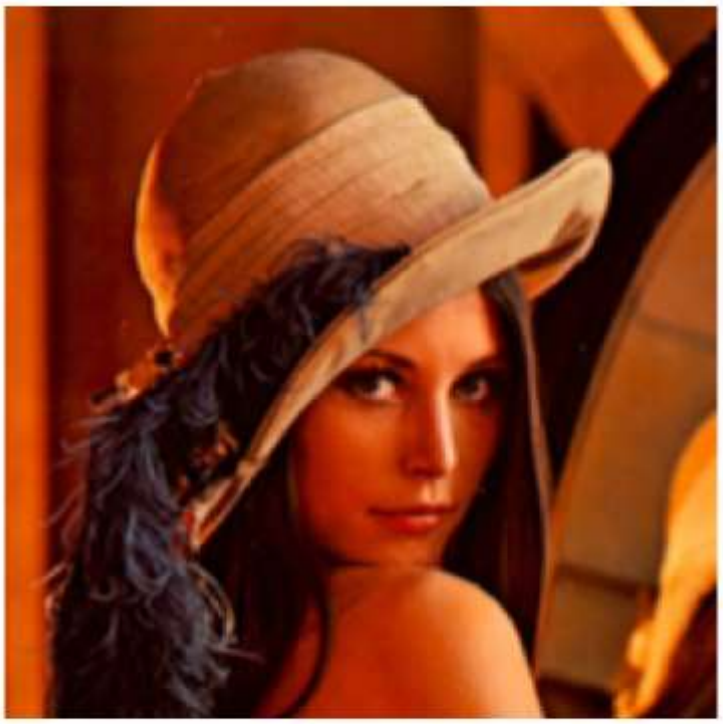
In [4]:

```
w = fspecial('average', 5);

frr = imfilter(fr, w, 'replicate');
fgg = imfilter(fg, w, 'replicate');
fbb = imfilter(fb, w, 'replicate');
new_rgb = cat(3, frr, fgg, fbb);

figure, imshow(new_rgb);

% or
% w = fspecial('average', 5);
% new_rgb = imfilter(rgb, w, 'replicate');
% figure, imshow(new_rgb);
```



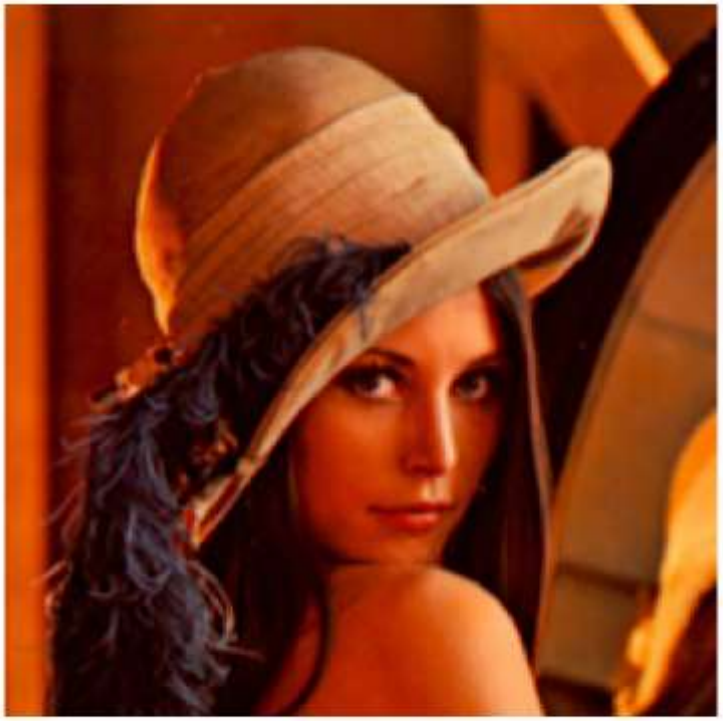
(4) Smooth only the intensity component of the HSI image using a 5×5 spatial averaging mask (leave the hue and saturation conponents unmodified) and convert the processed result to an RGB image. Show the result.

In [5]:

```
fii = imfilter(fi, w, 'replicate');

new_hsi = cat(3, fh, fs, fii);
new_hsi = hsi2rgb(new_hsi);

figure, imshow(new_hsi);
```



Show the 1st channel of difference between the two smoothed images.

In [15]:

```
diff = imsubtract(new_hsi, new_rgb);
% diff = new_rgb - new_hsi; % also right
% diff = new_hsi - new_rgb; % also right
figure, imshow(diff(:, :, 1));
% figure, imshow(diff(:, :, 1), []); % also right
```

2. Draw the following function in one figure shown below.

$$x(t) = \sum_{k=1}^{20} \frac{1}{k} \sin \frac{k\pi}{2} \cos \frac{k\pi t}{2}$$

where, $-5 \leq t \leq 5$

In [7]:

```
% 0.01, 0.001 are all right, 0.1 is wrong
t = -5 : 0.0001 : 5;
x = 0;
for k = 1:20
    x = x + 1/k * sin(k * pi/2) * cos(k * pi/2 * t);
end
plot(t, x)
title('Type your real name here, e.g. James Bond')
xlabel('t')
ylabel('x')
legend('x(t)')
```