Problem set 3: Toolboxes

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MATLAB release used: R2020a

Collaboration Info:

- https://de.mathworks.com/help/matlab/ref/stem3.html
- https://de.mathworks.com/help/matlab/ref/griddata.html
- https://de.mathworks.com/help/matlab/ref/meshc.html

Exercise 1. Area calculation.

MATLAB Code:

1. **stem3**

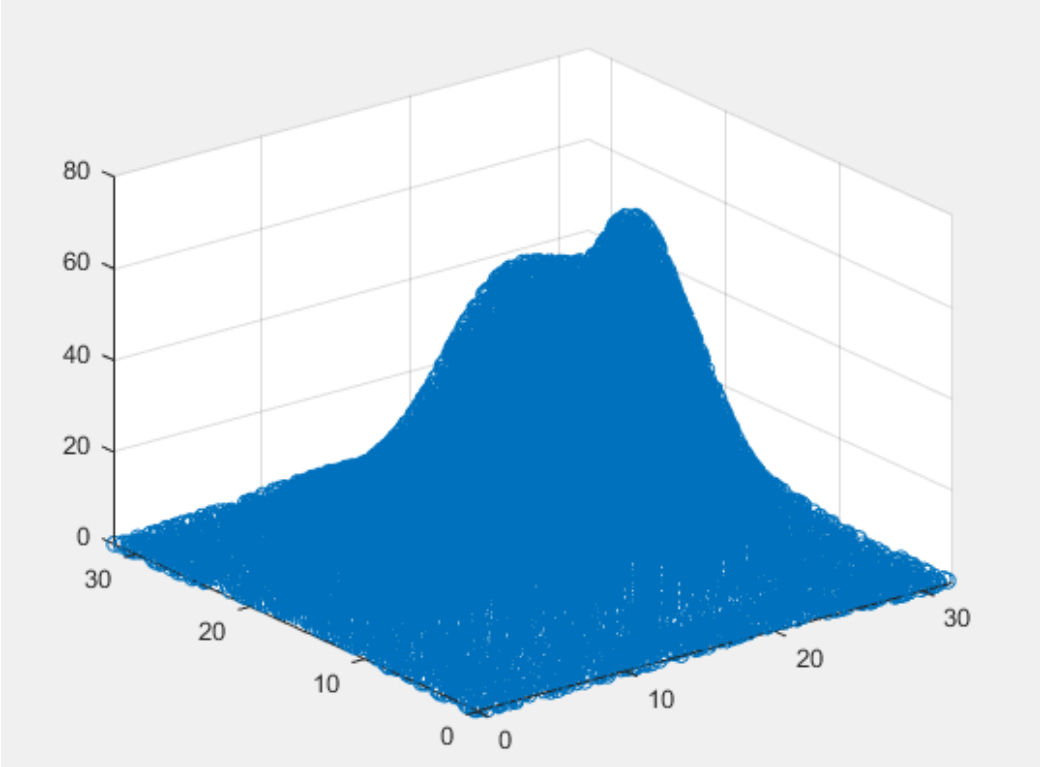
```
load('ex_1_data.mat')
stem3(vec_x, vec_y, function_value)
```

2. **meshgrid and contour**

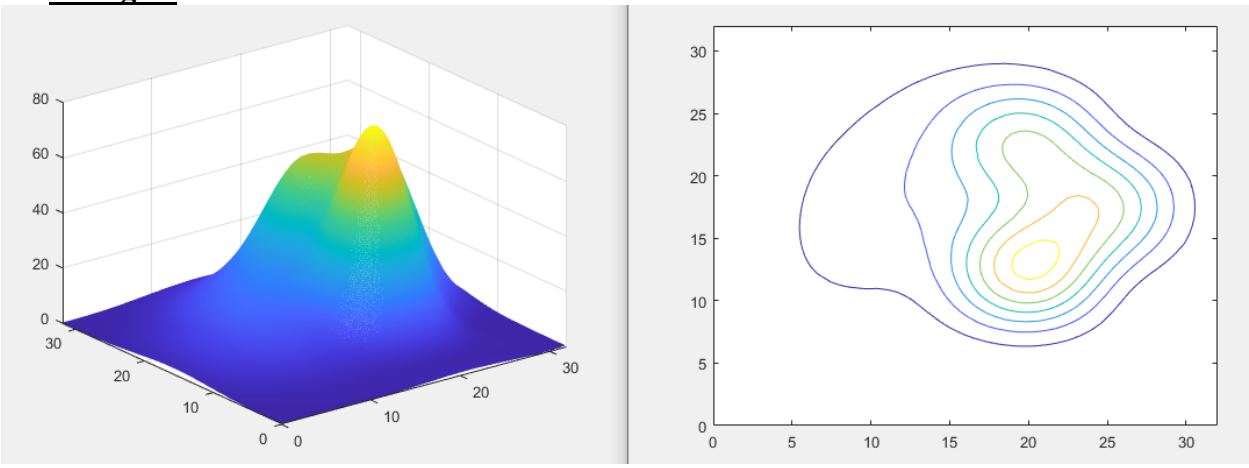
```
function area = area0()

load('ex_1_data.mat')

[x_grid,y_grid] = meshgrid(0:.1:L, 0:.1:L);
z_grid = griddata(vec_x,vec_y,function_value,x_grid,y_grid);

figure
mesh(x_grid,y_grid,z_grid)

figure
contour(x_grid,y_grid,z_grid)
end
```

Results:

1. `stem3`



2. **meshgrid**

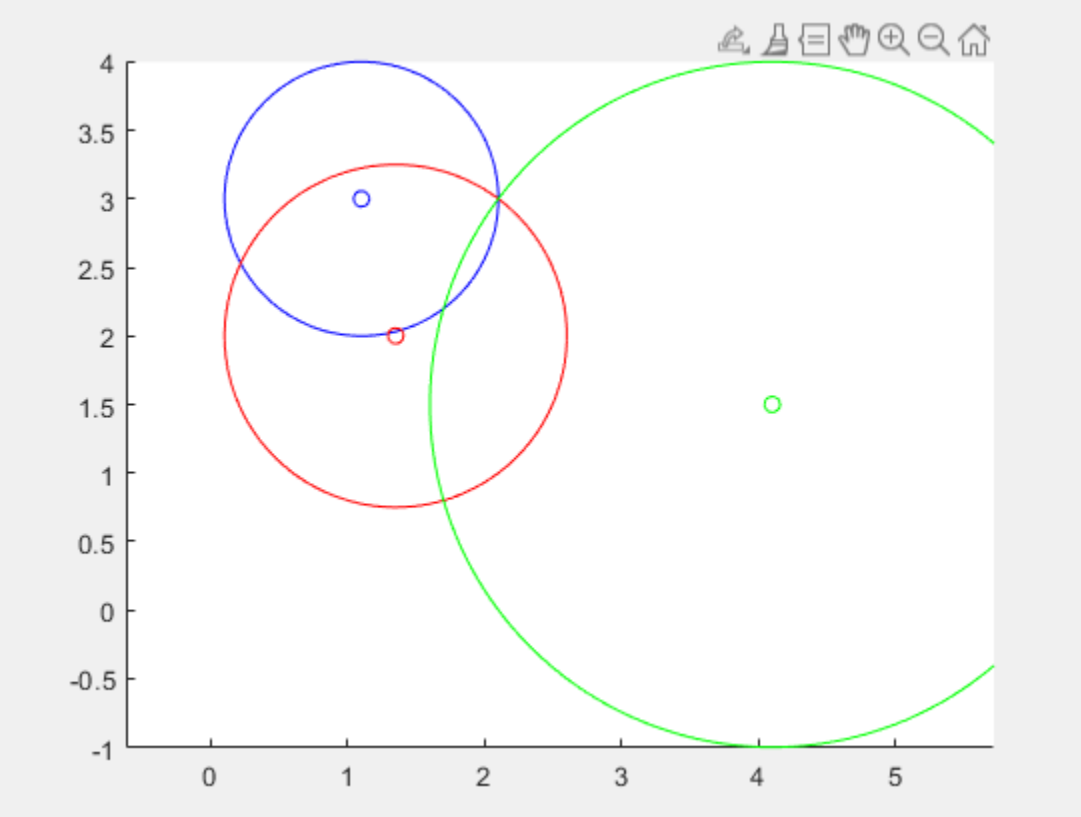


Exercise 1. Area calculation.

MATLAB Code:

```
function [lat, lon] = trilateration( lat_long_coord, distance)
r1 = distance(1);
r2 = distance(2);
r3 = distance(3);

a1 = lat_long_coord(1,1);
b1 = lat_long_coord(1,2);

a2 = lat_long_coord(2,1);
b2 = lat_long_coord(2,2);

a3 = lat_long_coord(3,1);
b3 = lat_long_coord(3,2);

colors = {'b', 'r', 'g', 'y'};

    figure
    axis equal
    hold on
    fimplicit(@(x, y)(x-a1).^2 + (y-b1).^2 - r1.^2, colors{1})
    plot(a1, b1, 'o', 'Color', colors{1})
    fimplicit(@(x, y)(x-a2).^2 + (y-b2).^2 - r2.^2, colors{2})
    plot(a2, b2, 'o', 'Color', colors{2})
    fimplicit(@(x, y)(x-a3).^2 + (y-b3).^2 - r3.^2, colors{3})
    plot(a3, b3, 'o', 'Color', colors{3})

%     fimplicit(@(x,y)(x-a1).^2 + (y-b1).^2 - r1.^2 + (x-a2).^2 + (y-b2).^2 -
r2.^2 + (x-a3).^2 + (y-b3).^2 - r3.^2, 'o', 'Color', colors{4})

% freceiver = @(x,y)(x-a1).^2 + (y-b1).^2 - r1.^2 + (x-a2).^2 + (y-b2).^2 -
r2.^2 + (x-a3).^2 + (y-b3).^2 - r3.^2;
% point = [0,0];
fsolve( @(x, y)(x-a1).^2 + (y-b1).^2 - r1.^2 + (x-a2).^2 + (y-b2).^2 - r2.^2
+ (x-a3).^2 + (y-b3).^2 - r3.^2, 0);

lat = x;
lon = y;
    plot(lat, long, 'o', 'Color', colors{4})
end
```

Results:



Exercise 1. Area calculation.

MATLAB Code:

```
dot_duration = 0.06;
tone_freq = 700;
sampling_frequency = 8000;
sampling_period = 1/sampling_frequency;
samples = 4000;

t = 0 : sampling_period*2*pi : dot_duration*2*pi;

[pulse_seq,sampling_frequency] = audioread('morse_audio_signal.wav');
message_length = length(pulse_seq);
figure
plot(pulse_seq(1:samples));

%sound(pulse_seq,sampling_frequency);

N = length(pulse_seq);
xdft = fft(pulse_seq);
xdft = xdft(1:N/2+1);
psdx = (1/(sampling_frequency*N)) * abs(xdft).^2;
psdx(2:end-1) = 2*psdx(2:end-1);
freq = 0:sampling_frequency/N:sampling_frequency/2;

figure
periodogram(pulse_seq,rectwin(N),N,sampling_frequency)
grid on
title("Periodogram Using FFT")
xlabel("Frequency (Hz)")
ylabel("Frequency (Hz)")



n = 0:1:(length(pulse_seq)-1);
sinusoidal_signal = pulse_seq.*(sin(2*pi*(tone_freq/sampling_frequency)*n))';
filtered_coefficients = fir1(64,5/(dot_duration*sampling_frequency));
result = filter(filtered_coefficients,1,sinusoidal_signal);

figure
stairs(result)

morse_derivate = diff(result);
plot(morse_derivate)
%findpeaks(morse_derivate, 0.005);

signal = findpeaks(morse_derivate, sampling_frequency);
disp(signal)
```

Results:

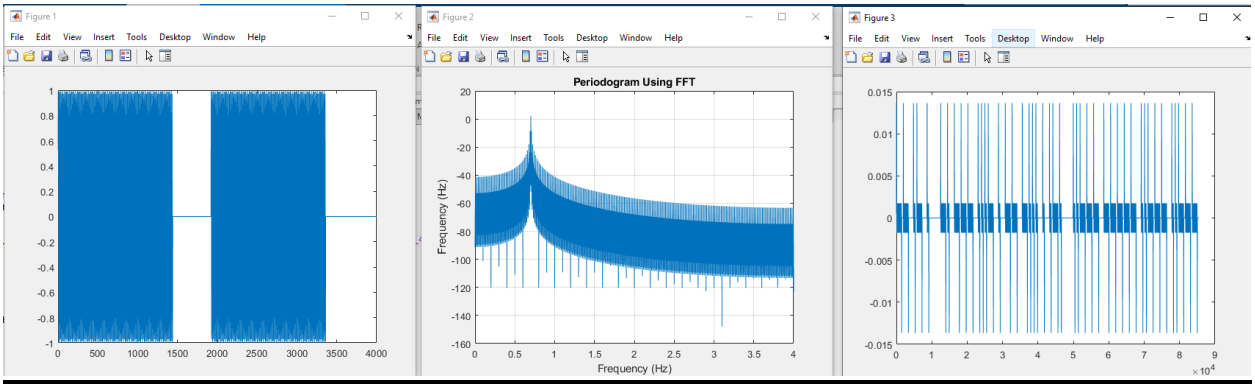


Figure 1
File Edit View Insert Tools Desktop Window Help
Figure 2
File Edit View Insert Tools Desktop Window Help
Periodogram Using FFT
Frequency (Hz)
Frequency (Hz)
Figure 3
File Edit View Insert Tools Desktop Window Help