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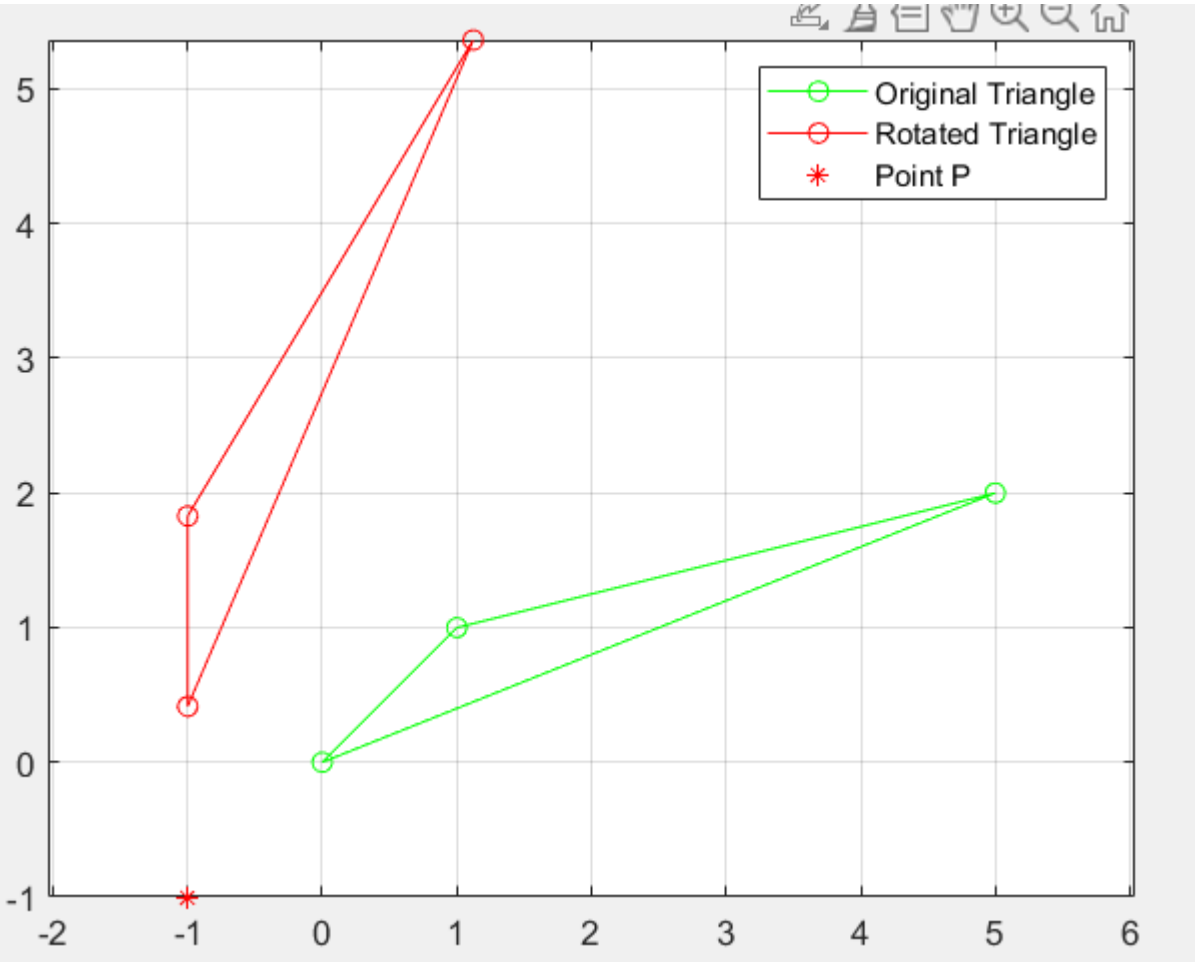
INTRODUCTION TO AI ROBOTICS

Labsheet – 2

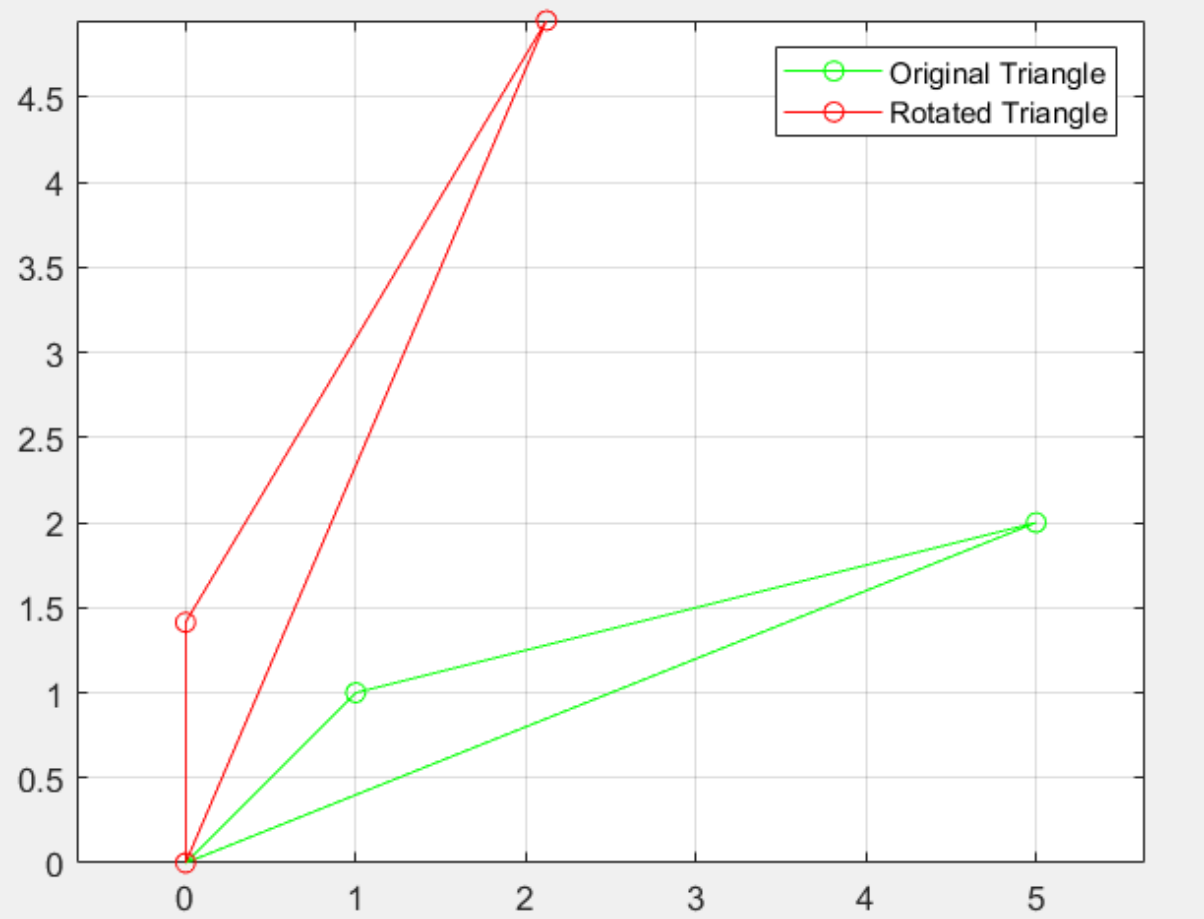
1. **Rotate a triangle placed at A(0,0), B(1,1) and C(5,2) by an angle 45 with respect to point P(-1,-1). Plot the points.**

```
clear all;
close all;

A = [0; 0];
B = [1; 1];
C = [5; 2];
P = [-1; -1];
Triangle = [A B C A];
plot(Triangle(1, :), Triangle(2, :), '-go', 'DisplayName', 'Original Triangle');
hold on;

% Rotation matrix
R = [cosd(45) -sind(45); sind(45) cosd(45)];

% Translation to Frame P
A1 = A - P;
B1 = B - P;
C1 = C - P;

% Rotation
A2 = R * A1;
B2 = R * B1;
C2 = R * C1;

% Translate back to World Frame
A3 = A2 + P;
B3 = B2 + P;
C3 = C2 + P;
Triangle2 = [A3 B3 C3 A3];
plot(Triangle2(1, :), Triangle2(2, :), '-ro', 'DisplayName', 'Rotated Triangle');

plot(P(1), P(2), 'r*', 'DisplayName', 'Point P');
axis equal;
grid on;
legend();
```



2. Rotate a triangle placed at A(0,0), B(1,1) and C(5,2) by an angle 45 with respect to origin. Plot the points

```
clear all;
close all;

A = [0; 0];
B = [1; 1];
C = [5; 2];
Triangle = [A B C A];
plot(Triangle(1, :), Triangle(2, :), '-go', 'DisplayName', 'Original Triangle');
hold on;

% Rotation matrix
R = [cosd(45) -sind(45); sind(45) cosd(45)];

% Rotation
A1 = R * A;
B1 = R * B;
C1 = R * C;
Triangle2 = [A1 B1 C1 A1];
plot(Triangle2(1, :), Triangle2(2, :), '-ro', 'DisplayName', 'Rotated Triangle');

axis equal;
grid on;
legend();
```


Original Triangle
Rotated Triangle
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5