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% Matlab routine: natural outbound and inbound run of a desert ant shown in
% geocentric (above) and egocentric (below) coordinates of the
% egocentric path integration model (II.2)

% With regard to the egocentric coordinates, the error postulated by
% Mueller and Wehner has been implemented during the outbound run

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Aus = xlsread('outbound_inbound.xls');
x = Aus(:,3);
y = Aus(:,4);
x1 = Aus(1,3);
y1 = Aus(1,4);
nx=length(x(~isnan(x)));
ny=y(~isnan(y));

X=0;
Y=0;


figure(1)
hold on
Xalt = 0;
Yalt = 0;
phialt = 0;
Xn = 0;
Yn= 0;

lmw = sqrt((x(2)-x(1))^2+(y(2)-y(1))^2);
phimw = atan2(y(2)-y(1),x(2)-x(1));
k = 3*sqrt(3)/(2*pi^3);
subplot(3,1,[1 2])
line([x(1) x(2)], [y(1) y(2)], 'LineWidth', 2, 'Color', 'red')
X = sqrt((x(2)-x(1))^2+(y(2)-y(1))^2);
Y = 0;
subplot(3,1,3)
line([1 2], [Xalt, X],  'LineWidth', 2, 'Color', 'magenta');
line([1 2], [Yalt, Y],  'LineWidth', 2, 'Color', 'blue');
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```
for i = 3:1:nx
    a = x(i-1);
    b = x(i);
    c = y(i-1);
    d = y(i);
    psi = atan2((d-c),(b-a));
    delta = mod(psi-phimw+pi,2*pi)-pi;
    Segmentlaenge = sqrt((d-c)*(d-c)+(b-a)*(b-a));
    tau = Segmentlaenge;
    phimw = phimw + k * Segmentlaenge*(pi+delta)*(pi-delta)*delta/lmw;
    lmw = lmw + Segmentlaenge*(1-abs(delta)/(pi/2));

    Xalt = X;
    Yalt = Y;
    X = -lmw*cos(delta);
    Y =  lmw*sin(delta);

    subplot(3,1,[1 2])
    a = x(i-1);
    b = x(i);
    c = y(i-1);
    d = y(i);
    line([a b], [c,d], 'LineWidth', 2, 'Color', 'red')
    axis equal
    subplot(3,1,3)
    line([0 700],[0 0],'LineWidth', 1, 'Color', 'black' )
    line([i-1 i], [Xalt, X],  'LineWidth', 2, 'Color', 'magenta');
    line([i-1 i], [Yalt, Y],  'LineWidth', 2, 'Color', 'blue');
    axis([0 700 -10 10])
    set(gca,'XTickLabel',{})
    pause(0.000001)
    Xalt = X;
    Yalt = Y;
end

lengthoutbound = i;

x = Aus(:,8) + 1.77;
y = Aus(:,9) - 9.91;
nx=length(x(~isnan(x)));
ny=y(~isnan(y));

for i = 2:1:nx
    a = x(i-1);
    b = x(i);
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```
    c = y(i-1);
    d = y(i);
    subplot(3,1,[1 2])
    line([a b], [c,d], 'LineWidth', 2, 'Color', 'green')
    axis equal
    hold on

    psi = atan2((d-c),(b-a));
    delta = mod(psi-phimw+pi,2*pi)-pi;
    Segmentlaenge = sqrt((d-c)*(d-c)+(b-a)*(b-a));
    phimw = phimw + k * Segmentlaenge*(pi+delta)*(pi-delta)*delta/lmw;
    lmw = lmw + Segmentlaenge*(1-abs(delta)/(pi/2));

    Xalt = X;
    Yalt = Y;
    X = -lmw*cos(delta);
    Y =  lmw*sin(delta);

    subplot(3,1,3)
    line([i - 1 + lengthoutbound, i + lengthoutbound], [Xalt, X],  'LineWidth', 2, 'Color', 'magenta');
    line([i - 1 + lengthoutbound, i + lengthoutbound], [Yalt, Y],  'LineWidth', 2, 'Color', 'blue');
    pause(0.000001);

end
```