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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
% Sommer 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;
for i = 1:1:(nx-1)
    a = x(i);
    b = x(i+1);
    c = y(i);
    d = y(i+1);
    phineu = atan2((d-c),(b-a));
    dphi = phineu - phialt;
    Segmentlaenge = sqrt((d-c)*(d-c)+(b-a)*(b-a));
    tau = Segmentlaenge;
    if dphi > 5/4 * pi
        dphi = dphi - 2 * pi;
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    elseif dphi < - 5/4 * pi
        dphi = dphi + 2 * pi;
    end
    dphi;
    Xn = (  cos(dphi)*X + sin(dphi)*Y)*(1-Segmentlaenge/90);
    Yn = (- sin(dphi)*X + cos(dphi)*Y)*(1-Segmentlaenge/90);
    X = Xn - Segmentlaenge;
    Y = Yn;
    subplot(3,1,[1 2])
    a = x(i);
    b = x(i+1);
    c = y(i);
    d = y(i+1);
    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;
    phialt = phineu;
end

lengthoutbound = i;



hold on

x = Aus(:,8);
y = Aus(:,9);
x1 = Aus(1,8) + 1.77;
y1 = Aus(1,9) - 9.91;
nx=length(x(~isnan(x)));
ny=y(~isnan(y));

hold on

for i = 1:1:(nx-1)
    a = x(i) + 1.77;
    b = x(i+1) + 1.77;
    c = y(i) - 9.91;
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    d = y(i+1) - 9.91;
    phineu = atan2((d-c),(b-a));
    dphi = phineu - phialt;
    Segmentlaenge = sqrt((d-c)*(d-c)+(b-a)*(b-a));
    tau = Segmentlaenge;
    if dphi > 5/4 * pi
        dphi = dphi - 2 * pi;
    elseif dphi < - 5/4 * pi
        dphi = dphi + 2 * pi;
    end
    dphi;
    Xn =   cos(dphi)*X + sin(dphi)*Y;
    Yn = - sin(dphi)*X + cos(dphi)*Y;
    X = Xn - Segmentlaenge;
    Y = Yn;
    a = x(i) + 1.77;
    b = x(i+1) + 1.77;
    c = y(i) - 9.91;
    d = y(i+1) - 9.91;
    subplot(3,1,[1 2])
    line([a b], [c,d], 'LineWidth', 2, 'Color', 'green')
    axis equal
    hold on
    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);
    Xalt = X;
    Yalt = Y;
    phialt = phineu;
end
```