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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)

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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;
   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;
   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;

phialt/pi*180;

atan2(Y,X)/pi*180;

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;
```

```
   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
```