Computing Assignment: Root Finding 2D contour

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        CA3_demo.m -- djm -- 29 jan 2019

        hi function
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```
% ========== PARAMETERS ========== %
b_phi = 3*pi/4;
s_phi = pi/2;
%  root-finding loop control parameters
% ds = 0.6; % For Bsect and fzero.
ds = 0.035; % For secant method.
% Nsteps = 24; % For Bsect and fzero.
Nsteps = 415; % For secant method.
% ================================ %

%  define domain in x and y
xx = -2.5:0.025:2.5;  yy = -2.5:0.025:2.5;

%  define a 'mesh' to plot on
[xg,yg] = meshgrid(xx,yy);

%  set root-finding tolerance (for initial pt & loop)
tol = 1e-10;
fzero_opt = optimset('TolX',tol);

%  useful future variables
%  itmax = 24;  delta = pi/50;

%  define the function HI(x,y)
hi = @(x,y) exp(-3*((x + 0.5).^2 + 2*y.^2)) + exp(-x.^2 -
 2*y.^2).*cos(4*x) - 1e-3;

%  define the function HI on the circle (radius = ds)
hi_th = @(th,xn,yn) hi(xn + ds*cos(th),yn + ds*sin(th));

%  find point on the "H" with y=0
%  initial guess for a point very NEAR contour
xi = -1.97; yi = 0;

%  START:  FIND INITIAL POINT on contour (you can use fzero here)
%  root-find angle to point ON contour
th = 0;
th = fzero(@(th) hi_th(th,xi,yi),th,fzero_opt);
%
%  END  :  FIND INITIAL POINT on contour

%  compute first point ON contour
xn = xi + ds*cos(th);
yn = yi + ds*sin(th);
```

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%  make array of contour points
zero_contour = zeros(Nsteps+1,2);
zero_contour(1,:) = [xn yn];


%  loop for the contour
for kk = 1:Nsteps
 %  START:  theta root-finding here (you cannot use fzero here!!)
 %
 %  fzero for next angle, using previous angle as initial guess

%  thn = fzero(@(th) hi_th(th,xn,yn),th,fzero_opt);
%     thn = BMethod(@(th) hi_th(th,xn,yn),th-b_phi, th+b_phi,tol);

    thn = SMethod(@(th) hi_th(th,xn,yn),th-s_phi, th+s_phi,tol);

    %
    %  END:  theta root-finding here

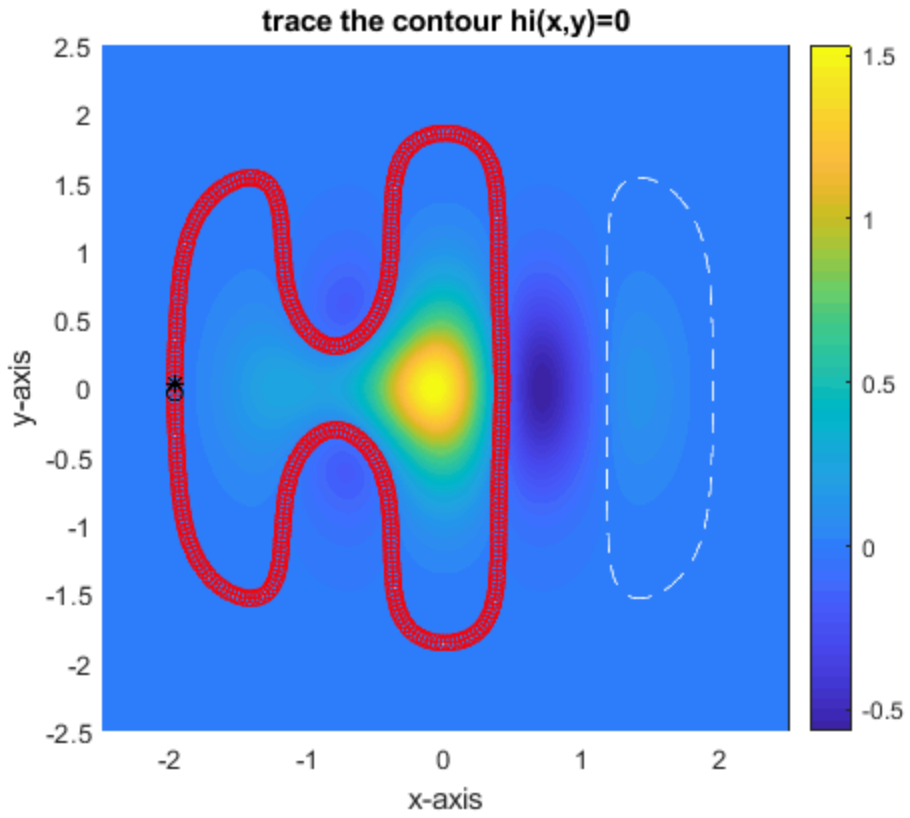
    % Compute next point on contour
 xn = xn + ds*cos(thn);
 yn = yn + ds*sin(thn);

    %  update new points & angle
 zero_contour(kk+1,:) = [xn yn];
 th = thn;
end

%  colour contourplot of HI function
figure(2);  clf
pcolor(xx,yy,hi(xg,yg));  colorbar
shading interp;  hold on
contour(xx,yy,hi(xg,yg),[0 0],'w--')
axis equal;  axis image

title('trace the contour hi(x,y)=0')
xlabel('x-axis')
ylabel('y-axis')

%  plot the zero-contour, 1st & last point
plot(zero_contour(:,1),zero_contour(:,2),'ro-')
plot(zero_contour(1,1),zero_contour(1,2),'ko')
plot(zero_contour(end,1),zero_contour(end,2),'k*')
```



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