~\Documents\documents_general\structured_courses\math564\evaluations\projects\p05\solve6.m

```
 1
 2 % solve the minimum time path problem
 3 % use sinusoidal parameterization to order n
 4 n=4;
 5
 6 % read in the velocity data array defined on
 7 % [0,1]x[0,1] and set the path end points
 8 pathpar=[];
 9 pathpar.v=readmatrix('SpeedData.csv');
10 [my,mx]=size(pathpar.v);
11 pathpar.A=[.05 .05];
12 pathpar.B=[.95 .95];
13
14 % add obstruction
15 %[yo,xo]=ndgrid(1:my,1:mx);
16 %yc=my/2+55;xc=mx/2+45;
17 %pathpar.v((yo-yc).^2+(xo-xc).^2<1600)=0.01;
18
19 % set optimization parameters
20 pr.objective=@pathtime;
21 pr.par=pathpar;
22 pr.x0=0.1*randn(2*n,1);
23 pr.method='BFGS';
24 pr.linesearch='StrongWolfe';
25 pr.dftol=1E-8;
26 pr.ngtol=1E-8;
27 pr.dxtol=1E-8;
28 pr.c1=0.001;
29 pr.c2=0.9;
30 pr.m=5;
31 pr.maxiter=999;
32 pr.progress=10;
33
34 % call the optimization routine
35 out=optimize(pr);
36
37 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
38 % plot the optimal path overlayed on the velocity map
39 % first, set up graphics parameters
40 FontSize=24;        % size of figure fonts
41 LineWidth=3;        % width of path line
42 PointSize=100;      % path end point area
43 LineColor=[1 1 1];  % path color
44 ColorMap=jet(512);  % velocity color map
45 NumPathPoints=1000; % number of points (s) defining the path
46 FigureScale=1.4;    % figure size scale on screen
47
48 % start the figure drawing
49 figure('position',FigureScale*[200 200 950 800]);
50 % draw the velocity map
51 imagesc(pathpar.v)
```

```
colormap(ColorMap)
% set axes parameters
set(gca,'xtick',[],'ytick',[],'box','on')
hc=colorbar('fontsize',FontSize);
TL=get(hc,'ticklabels');
for k=1:length(TL)
    TL{k}=num2str(str2double(TL{k}),'%.1f');
end
set(hc,'ticklabels',TL);
% and add the starting and ending positions to the plot
hold on
scatter([pathpar.A(1) pathpar.B(1)]*mx,[pathpar.A(2) pathpar.B(2)]*my,...
    PointSize,LineColor,'filled')
% compute the path and add to the plot (this must match
% the computation of the objective function)
s=linspace(0,1,NumPathPoints)';
xx=(1-s)*pathpar.A(1)+s*pathpar.B(1);
yy=(1-s)*pathpar.A(2)+s*pathpar.B(2);
for k=1:n
    S=sin(k*pi*s);
    xx=xx+out.x(k,end)*S;
    yy=yy+out.x(k+n,end)*S;
end
xxs=1+xx*(mx-1);
yys=1+yy*(my-1);
plot(xxs,yys,'color',LineColor,'linewidth',LineWidth)

%saveas(gcf,'minpathex.png')

% start the figure drawing
figure('position',FigureScale*[200 200 950 800]);
% draw the velocity map
imagesc(pathpar.v)
colormap(ColorMap)
% set axes parameters
set(gca,'xtick',[],'ytick',[],'box','on')
hc=colorbar('fontsize',FontSize);
TL=get(hc,'ticklabels');
for k=1:length(TL)
    TL{k}=num2str(str2double(TL{k}),'%.1f');
end
set(hc,'ticklabels',TL);
% and add the starting and ending positions to the plot
hold on
scatter([pathpar.A(1) pathpar.B(1)]*mx,[pathpar.A(2) pathpar.B(2)]*my,...
    PointSize,LineColor,'filled')
```