function newshape =morph(unmorph,d2)

% fname='foil.dat';

%name='Airfoil';

%AF = Airfoil;

%--------------------------------------------------------------------------

%--------------------------------------------------------------------------

%Camber Morphing of an Airfoil

%This is a simple morphing function which changes the camber by deflecting

%the leading edge and trailing edge. A part of the airfoil is kept fixed in

%the morphing where the servos will be housed. The input commaneds are:

% airfoil = which is the airfoil data to be morphed (got from

% airfoiltools.com or any other similar data set), (please

% note the data which is imported in workspace needs to be

% similar as the format of airfoiltools.com to work)

% leR = 1st control point in terms of camber ratio(x/c). This is the

% point before which the the airfoil starts morphing to the

% leading edge

% teR = 2nd control point similar to leR but deflects the trailing edge

% d1 = leading edge deflection

% d2 = trailing edge deflection

%Example:

% import naca2012 airfoil data(only shape, not the camber) as Nx2 matrix

% %note: all the dimensions are in mm

%Input

% a = morph(naca0012,0.2,0.4,2,10)

%Output

% a(1:N,1:2) morphed airfoil data with deflection of 2mm of LE and 10mm

% of TE

%--------------------------------------------------------------------------

%--------------------------------------------------------------------------

%%

% function save(this,filename)

% fid=fopen(filename,'w+');

% fprintf(fid,'%s\n',this.Name);

% fprintf(fid,' %f %f \n',[flipud(this.UpperX) flipud(this.UpperY)].');

% fprintf(fid,' %f %f \n',[this.LowerX(2:end) this.LowerY(2:end)].');

% fclose(fid);

% end

newshape=unmorph;%assigning airfoil data to newshape

N = size(unmorph,1);

d1 = 0;

leR = 0.2;

teR = 0.4;

% if leR>teR

% disp('error')

% else

%%

%plot(airfoil(:,1),airfoil(:,2),'-') %plots initial airfoil for comparision

%hold on

n1=round((1-leR)\*(N+1)/2);

n2=round((1-teR)\*(N+1)/2);

n=round((N+1)/2);

L=unmorph(n2,1)-unmorph(n1,1);%length of fixed portion

L1=unmorph(n1,1)-unmorph(n,1);%length of leading edge protion

L2=unmorph(1,1)-unmorph(n2,1);%length of trailing edge portion

%%

for k=n1:n %morphing for leading edge

x=(unmorph(n1,1)-unmorph(k,1));

newshape(k,2)=unmorph(k,2)-d1/L1^3\*(x\*L1^2+x\*L1-x^2);

newshape(N-k+1,2)=unmorph(N-k+1,2)-d1/L1^3\*(x\*L1^2+x\*L1-x^2);

end

for k=1:n2 %morphing for trailing edge

x=(unmorph(k,1)-unmorph(n2,1));

newshape(k,2)=unmorph(k,2)-d2/L2^3\*(x\*L2^2+x\*L2-x^2);

newshape(N-k+1,2)=unmorph(N-k+1,2)-d2/L2^3\*(x\*L2^2+x\*L2-x^2);

end

newshape = newshape/unmorph(1,1);

%transformation relation V=VL/L^3\*(Z\*L^2+Z\*L-Z^2); VL= deflection

%% %plots of morphed airfoil

% x1=newshape(1:n,1); y1=newshape(1:n,2);

% x2=newshape(n:N,1); y2=newshape(n:N,2);

% cs = csapi(x1,y1);

% fnplt(cs,1,'b')

% hold on

% cs1 = csapi(x2,y2);

% fnplt(cs1,1,'b')

% hold on

% for k=[n1 n2 N+1-n1 N+1-n2] %plots control points

% plot(newshape(k,1),newshape(k,2),'o')

% hold on

% end

% axis([-airfoil(1,1) airfoil(1,1) -airfoil(1,1) airfoil(1,1)])

% pbaspect([1 1 1])

%% Some other representations

% af.X=newshape(:,1)/unmorph(1,1);

% af.Y=newshape(:,2)/unmorph(1,1);

% for k = 1:((N+1)/2)

% modshape.UpperX(k) = newshape(((N+1)/2)-k+1,1)/unmorph(1,1);

% modshape.UpperY(k) = newshape(((N+1)/2)-k+1,2)/unmorph(1,1);

% end

% for l = ((N+1)/2):N

% modshape.LowerX(l+1-(N+1)/2) = newshape(l,1)/unmorph(1,1);

% modshape.LowerY(l+1-(N+1)/2) = newshape(l,2)/unmorph(1,1);

% end

% modshape.Name='morphed';

% modshape;

%% For Xfoil

% plot(modshape.x,modshape.y)

% axis([-1 1 -1 1])

% pbaspect([1 1 1])

% AF = modshape;

% AF.UpperX = transpose(modshape.UpperX);

% AF.UpperY = transpose(modshape.UpperY);

% AF.LowerX = transpose(modshape.LowerX);

% AF.LowerY = transpose(modshape.LowerY);

% AF.Name = 'morph';

%

% f.datfilepath = './';

% f.designation = '0015';

% AF;

%

% F1=AF.Name;

% F2=num2str([af.X af.Y]);

% F=strvcat(F1,F2);

% Name=[f.datfilepath 'morph' f.designation '.dat'];

% dlmwrite(Name,F,'delimiter','')

%

% af;

% f;

%Airfoil(filename)

% save(AF,Name)

%%

% fileID = fopen(fname,'w');

% %fprintf(fileID,'%12s\r\n',name);

% for i=1:N

% fprintf(fileID,'%1.5f %1.5f \r\n',newshape(i,1),newshape(i,2));

% end

% fclose(fileID);

end