polysurf

-a bilinear surface based on bleding of 4 polylines implemented in MATLAB®

Date: 10/2016

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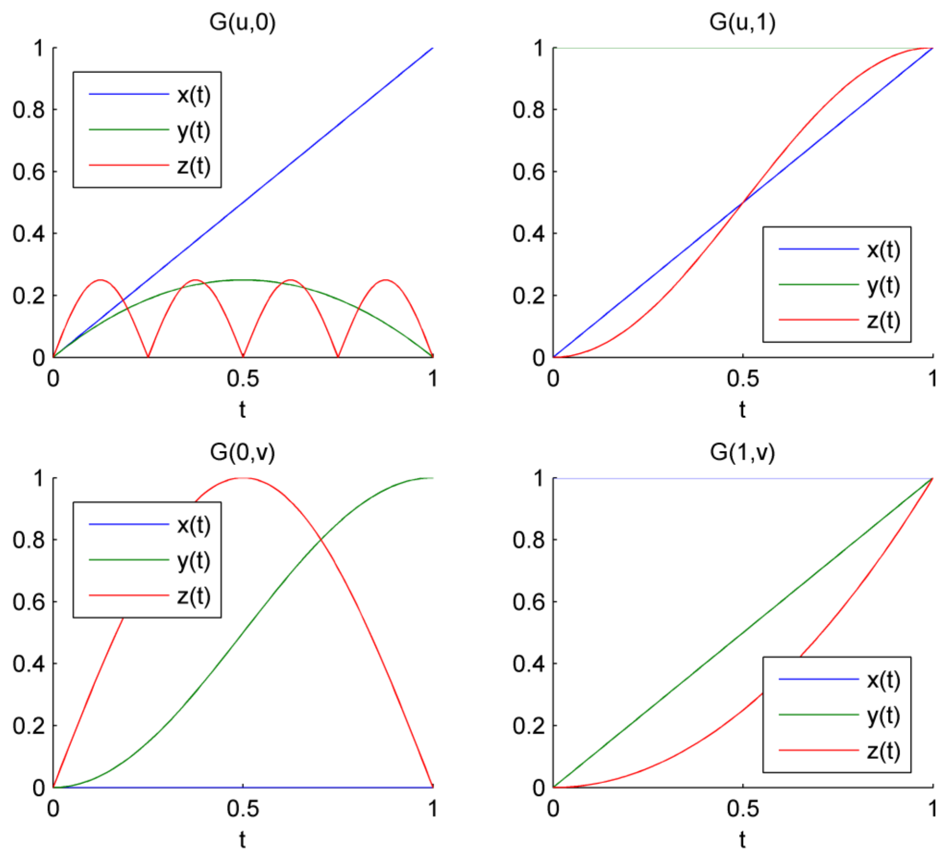
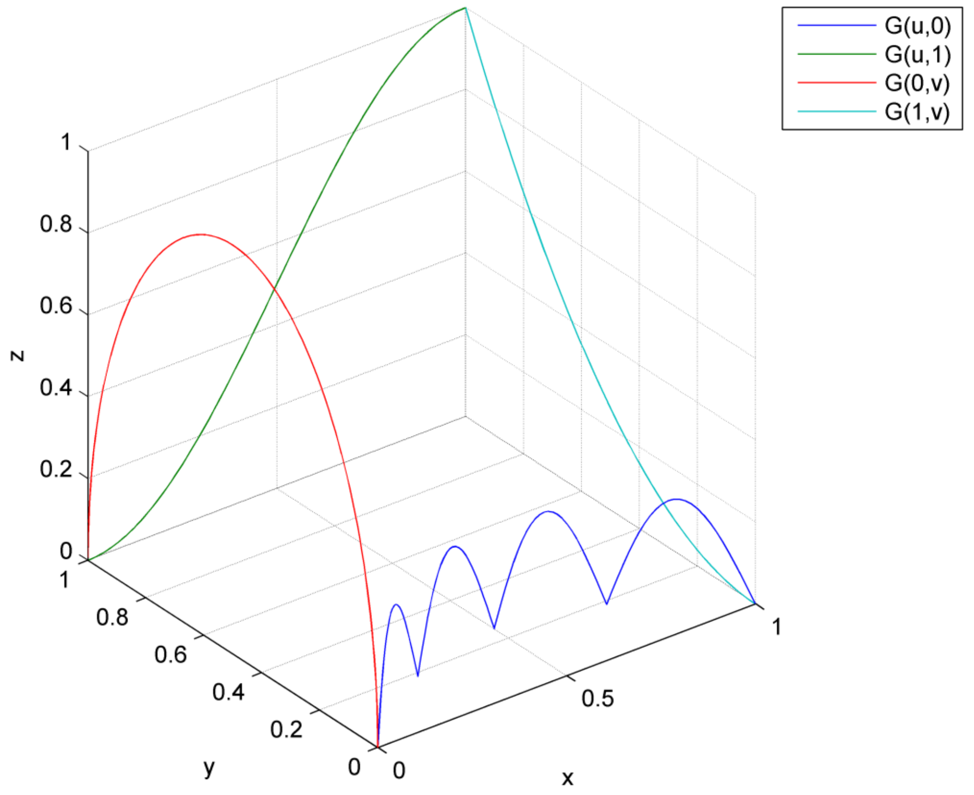
Step 1 – Define surface boundary functions



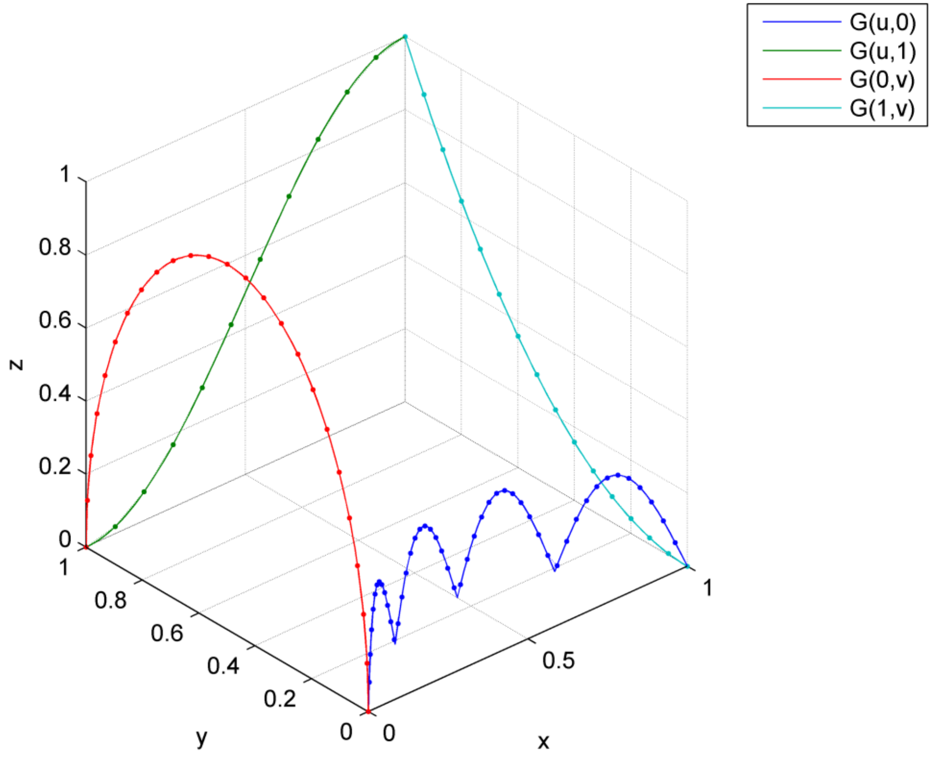

```
% G(u,0) -- parabolically twisted abs. sine
Gu0 = { @(t) t; ...
        @(t) -4*.25*t.*(t-1); ...
        @(t) abs(.25*sin(4*pi*t)) };

% G(u,1) -- squared quarter sine
Gu1 = { @(t) t; ...
        @(t) ones(size(t)); ...
        @(t) sin(pi/2*t).^2 };

% G(0,v) -- circular arc
G0v = { @(t) zeros(size(t)); ...
        @(t) (1/2)*(1-cos(pi*t)); ...
        @(t) sin(pi*t) };

% G(1,v) -- parabolic
G1v = { @(t) ones(size(t)); ...
        @(t) t; ...
        @(t) t.^2 };
```

Step 1 – View surface boundary functions



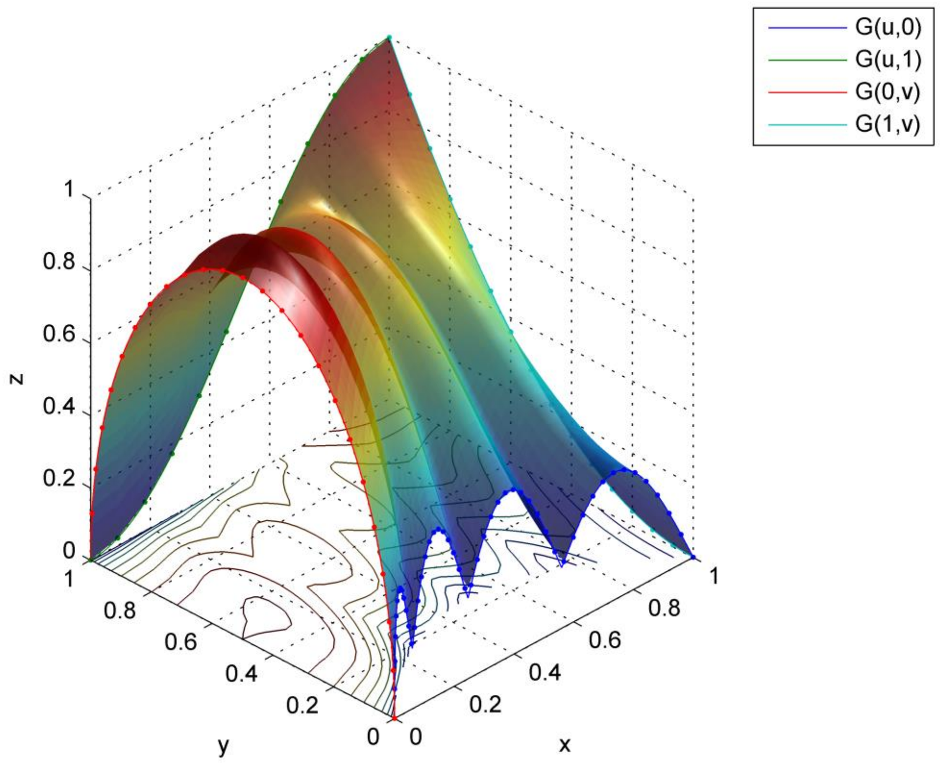

```
fh3d = figure('name','3-d plot');
    set(gcf,'renderer','opengl','doublebuffer','on')
    set(gca,'fontsize',9)
    cameratoolbar
    X = [Gu0{1}(t); Gu1{1}(t); G0v{1}(t); G1v{1}(t)]';
    Y = [Gu0{2}(t); Gu1{2}(t); G0v{2}(t); G1v{2}(t)]';
    Z = [Gu0{3}(t); Gu1{3}(t); G0v{3}(t); G1v{3}(t)]';
    ph = plot3(X,Y,Z);
    view(3)
    grid on
    xlabel('x'),ylabel('y'),zlabel('z')
    title('Surface boundary curves')
    legend('G(u,0)','G(u,1)','G(0,v)','G(1,v)',...
        'location','eastoutside')
```

Step 2 – Generate polylines by sampling




```
t1 = linspace(0,1, 50);
t2 = linspace(0,1, 12);
t3 = linspace(0,1, 25);
t4 = linspace(0,1, 16);

% Store sampled boundary functions into a 4-cell array
P = cell(1,4);
P{1} = [Gu0{1}(t1); Gu0{2}(t1); Gu0{3}(t1)];  % G(u,0)
P{2} = [Gu1{1}(t2); Gu1{2}(t2); Gu1{3}(t2)];  % G(u,1)
P{3} = [G0v{1}(t3); G0v{2}(t3); G0v{3}(t3)];  % G(0,v)
P{4} = [G1v{1}(t4); G1v{2}(t4); G1v{3}(t4)];  % G(1,v)

% To view the content in P
% P{1},P{2},P{3},P{4}

% Output the individual polylines in the 3-d view
hold on
for k=1:4
    plot3(P{k}(1,:),P{k}(2,:),P{k}(3,:),'.:',...
        'Color',get(ph(k),'Color'))
end
hold off
```

Step 3 – Generate bilinear surface




```
surfu = 50;
surfv = 50;

disp('Generating surface ...')
[Gx,Gy,Gz] = polysurf(P,surfu,surfv);

hold on
% plot3(Gx,Gy,Gz,'.')
sh = surf(Gx,Gy,Gz);
set(sh,'linestyle','none','facealpha',.75)
hold off
axis equal

% add some shading
lighting phong
light
```