Mini-Matlab Lesson 20: Separation of variables for Laplace's equation 1

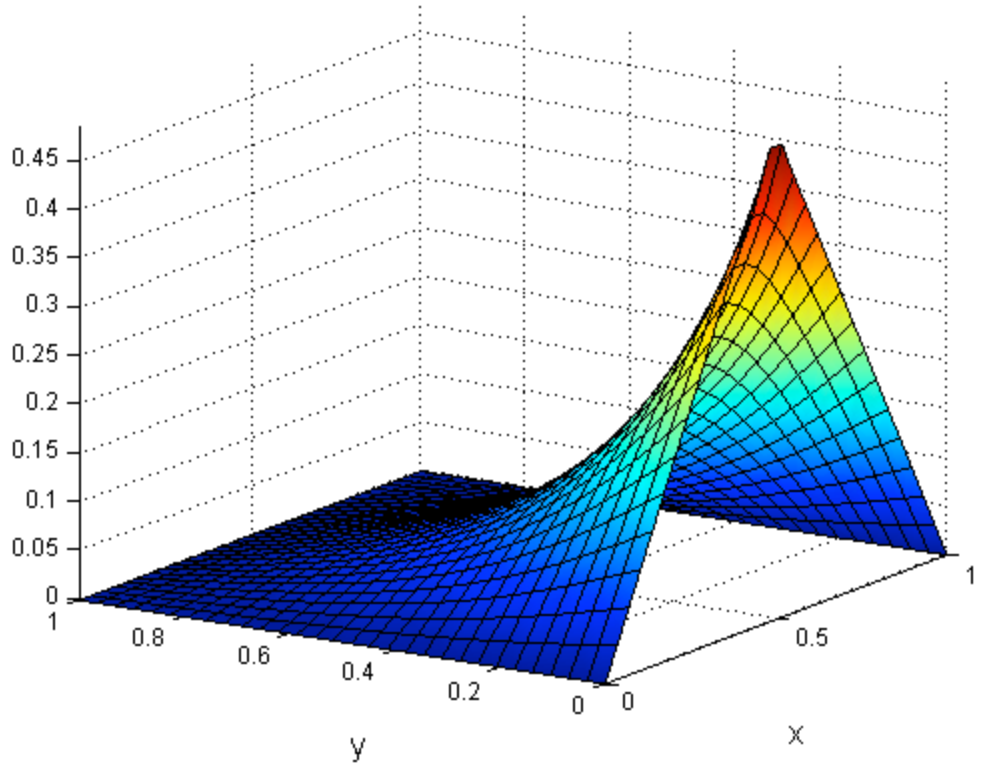
Solution of Laplace's equation for a membrane stretched over a rectangular wire frame

```
clear;
close all;

N = 16;
x = linspace(0, 1, 30);
y = linspace(0, 1, 30);
[X,Y] = meshgrid(x,y);
U = 0*X;

f = figure;
hold on;
for j = 1:length(y)
    tmp = 0;
    for k = 0:N
        tmp = 4/pi^2*(-1)^k/(2*k+1)^2/sinh((2*k+1)*pi) ...
                *sinh((2*k+1)*pi*(1-y(j)))*sin((2*k+1)*pi*x);
        U(j,:) = U(j,:) + tmp;
    end
end

s = surf(X,Y,U);
set(s, 'FaceColor', 'interp');
view([-57, 18]);
axis tight
grid on;
xlabel('x', 'FontSize', 16);
ylabel('y', 'FontSize', 16);
title('Membrane on rectangular wire with fourier modes = 16', 'FontSize', 16);
```



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Mini-Matlab Lesson 20: Separation of variables for Laplace's equation 2

Solution of Laplace's equation for a membrane stretched over a circular helix

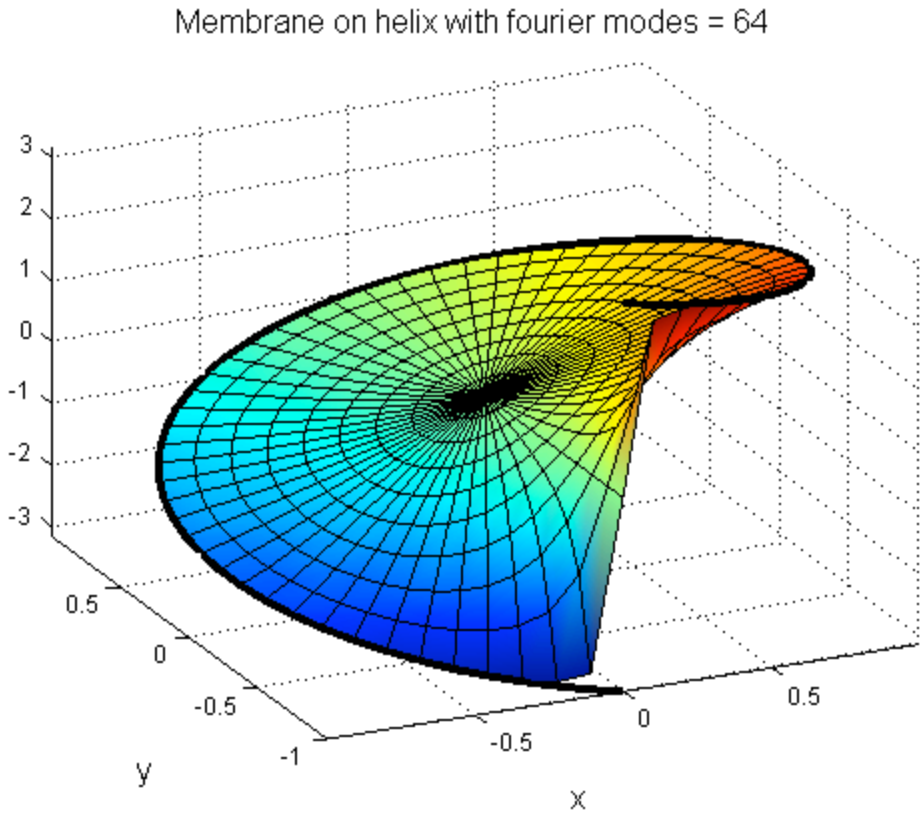
```
clear;
close all;

N = 64;
r = linspace(0, 1, 10);
t = linspace(-pi, pi, 60);
[R,T] = meshgrid(r,t);
U = 0*R;

f = figure;
hold on;
for j = 1:length(t)
    tmp = 0;
    for k = 1:N
        bk = 2/k*(-1)^(k+1);
        U(j,:) = U(j,:) + bk*sin(k*t(j))*r.^k;
    end
end

s = surf(R.*sin(T),R.*cos(T),U);
hold on;
plot3(sin(t), cos(t), t, 'k', 'LineWidth', 3);
hold off;

set(s, 'FaceColor', 'interp');
view([-25, 30]);
grid on
axis tight
xlabel('x', 'FontSize', 16);
ylabel('y', 'FontSize', 16);
title('Membrane on helix with fourier modes = 64', 'FontSize', 16);
```



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