```
syms x y
f(x,y) = x*sin(pi*x)*y*(y-2)
```

$$f(x,\ y) = x\,y\sin(\pi\,x)\ (y-2)$$

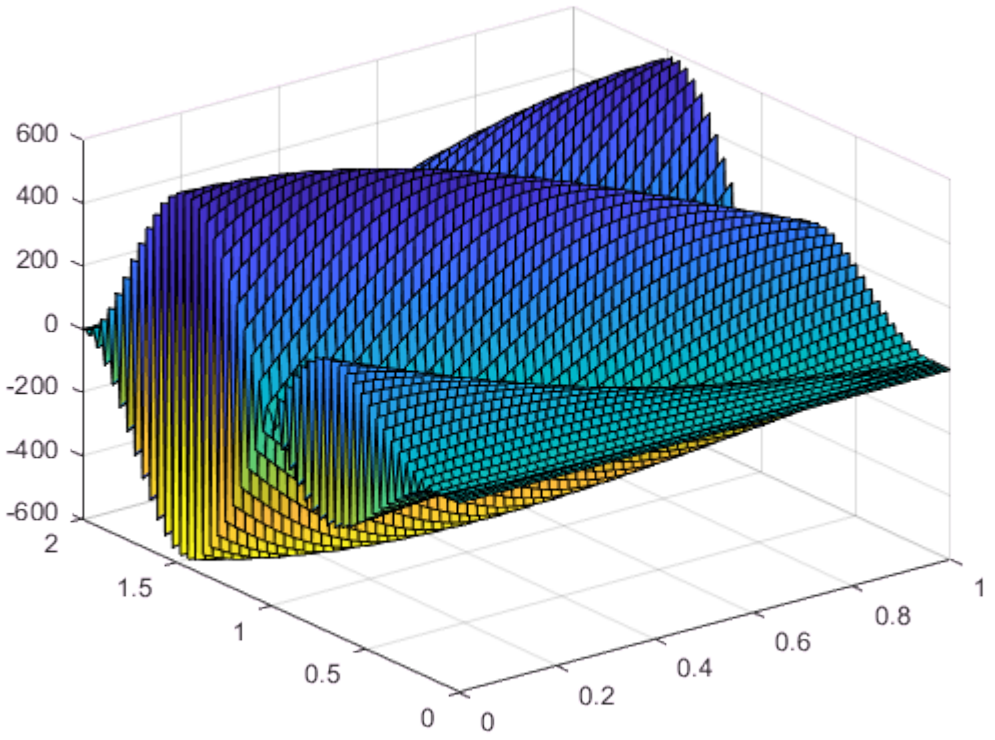
```
Z(x,y) = diff(f(x,y),2) %exact solution of f(x,y)
```

$$Z(x,\ y) = 2\,\pi\ y\cos(\pi\,x)\ (y-2) - x\,y\,\pi^2\sin(\pi\,x)\ (y-2)$$

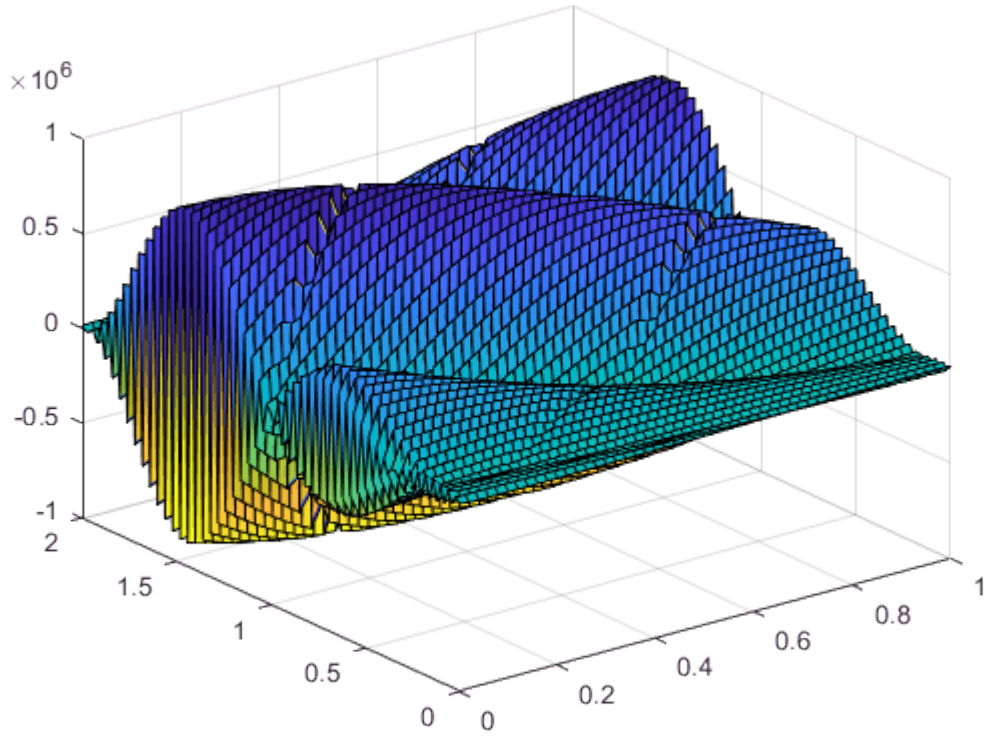
```
%generate the matrix u
h = 0.02;
a = 0-0.02;
b = 0-0.02;
for m = 1:(2/0.02+1)
    b = b + h;
    for n = 1:(1/0.02+1)
        a = a + h;
        U(m,n) = a*sin(pi*a)*b*(b-2);
        E_S(m,n) = double(Z(a,b)); %E_S here is the matrix of the exact solution
    end
end
```

```
[M,N] = size(U);
U = U(:);
A = diag(ones(N,1)*-2) + diag(ones(N-1,1),1) + diag(ones(N-1,1),-1);
B = diag(ones(M,1)*-2) + diag(ones(M-1,1),1) + diag(ones(M-1,1),-1);
A = A / h^2;
B = B / h^2;
Im = diag(ones(M,1));
In = diag(ones(N,1));
Kron_M = kron(Im,A) ;
Kron_M = Kron_M + kron(B',In);
F =Kron_M * U;
F_re = reshape(F,101,51);
```

```
x = linspace(0,1,51);
y = linspace(0,2,101);
[X,Y] = meshgrid(x,y);
surf(X,Y,E_S);
```


600
400
200
0
-200
-400
-600
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1

```
surf(X,Y,F_re);
```


×10^6
1
0.5
0
-0.5
-1
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1

```
Diff = F_re - E_S;
norm(Diff,Inf) %infinity norm of the difference between the two solutions
```

```
ans = 2.9600e+07
```

```
norm(E_S, Inf) %infinity norm of the exact solution
```

```
ans = 1.9627e+04
```

```
norm(Diff,Inf) / norm(E_S,Inf) %Ratio
```

```
ans = 1.5081e+03
```

```
%I would check the solution of the hw for this part, cause I don't what the norm means here =
```