

## FreeFem++ + Gmsh + gnuplot + python

poission.geo

```
SetFactory("OpenCASCADE");

Rectangle(1) = {-1, -0.5, 0, 2, 1, 0};

Circle(5) = {-0.5, -0, 0, 0.125, 0, 2*Pi};
Curve Loop(2) = {5};
Surface(2) = {2};

Translate {0.5, 0, 0} {
  Duplicata { Surface{2}; }
}
Translate {0.5, 0, 0} {
  Duplicata { Surface{3}; }
}

BooleanDifference{ Surface{1}; Delete; }{ Surface{2}; Surface{3}; Surface{4}; Delete; }

MeshSize {10, 8, 9, 11, 5, 6, 7} = 0.05;

Physical Curve("left", 1000) = {9};
Physical Curve("top", 1001) = {11};
Physical Curve("right", 1002) = {10};
Physical Curve("bottom", 1003) = {8};

Physical Curve("circle", 2000) = {5, 6, 7};
Physical Surface("rectangle", 3000) = {1};

Mesh 2;
```

poisson.edp

```
load "gmsh";
//load "Element_P3" // [P3] piecewise P3 continuous finite element(2d)

// The triangulated domain Th is on the left side of its boundary
```

```

mesh Th = gmshload("./outputs/poisson.msh");
plot(Th,wait=true); // plot(Th,wait=true,ps="Th.eps");

fespace Vh(Th, P1);
// Define u and v as piecewise-P1 continuous functions
Vh u,v;

// Poisson Eq:  $-\Delta u = f$ 
//  $-\nabla u = f$ 
func f = x*y;

// Define the PDE
solve Poisson(u,v) = int2d(Th)(dx(u)*dx(v) +
    dy(u)*dy(v)) -
    int2d(Th)(f*v) +
    on(1000, 1001, 1002, 1003, u=0) +
    on(2000, u=0);

plot(u,dim=3, ps="outputs/poisson.eps", fill=true, wait=true);

ofstream sol("outputs/u.csv");
for(int j=0; j<Th.nv; j++) {
    sol << Th(j).x << "," << Th(j).y << "," << u[] [j] << endl;
}

ofstream tri("outputs/Th.csv");
for(int i=0;i<Th.nt;i++){
    tri << Th[i] [0] << "," << Th[i] [1] << "," << Th[i] [2] << endl;
}

ofstream gp("outputs/gnuplot.gp");
for (int i = 0; i < Th.nt ; i++){
    for (int j = 0; j < 3; j++){
        gp << Th[i] [j].x << " " << Th[i] [j].y << " " << u[] [Vh(i,j)] << endl;
    }
    gp << Th[i] [0].x << " " << Th[i] [0].y << " " << u[] [Vh(i,0)] << endl << endl << endl;
}

```

FreeFem++: poisson.eps

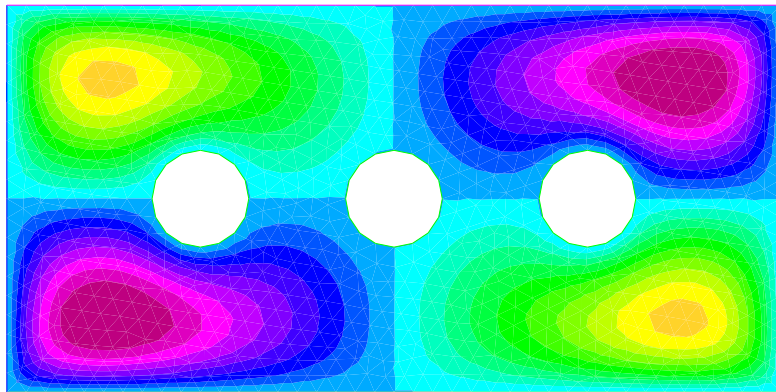


Figure 1 poisson.eps

Gnuplot: gnuplot.eps

Python: python.eps

"/outputs/gnuplot.gp" —

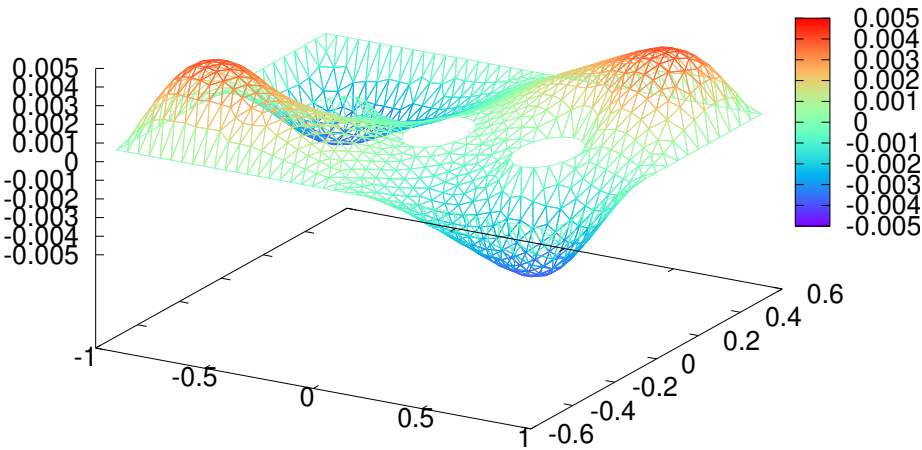


图 2 gnuplot.eps

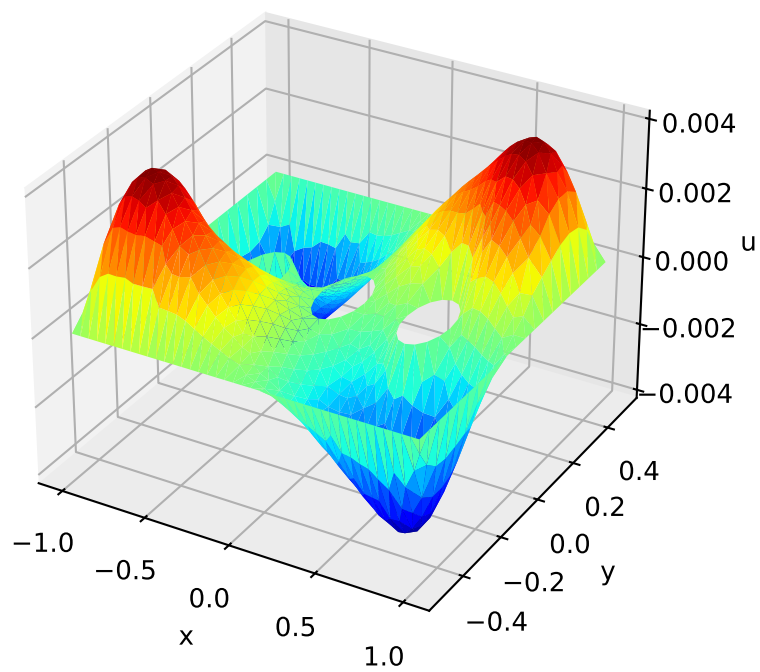


图 3 python.eps