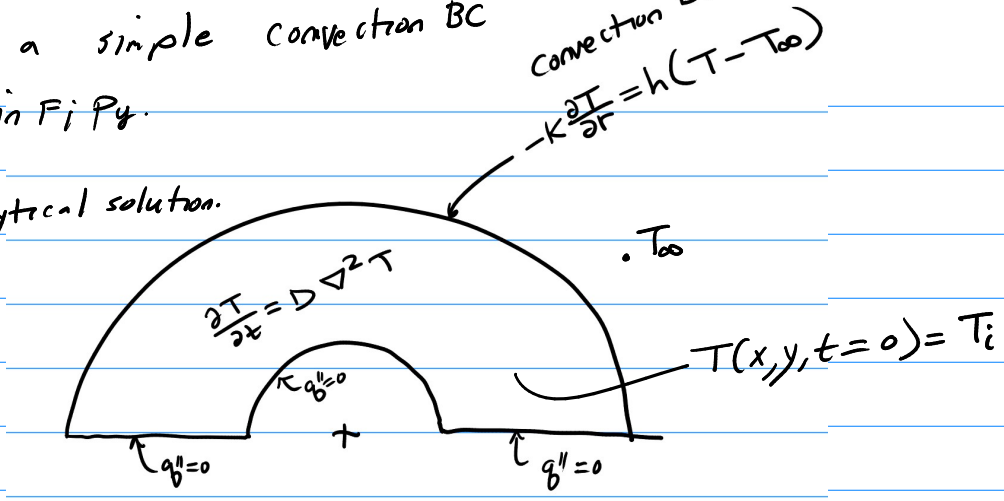
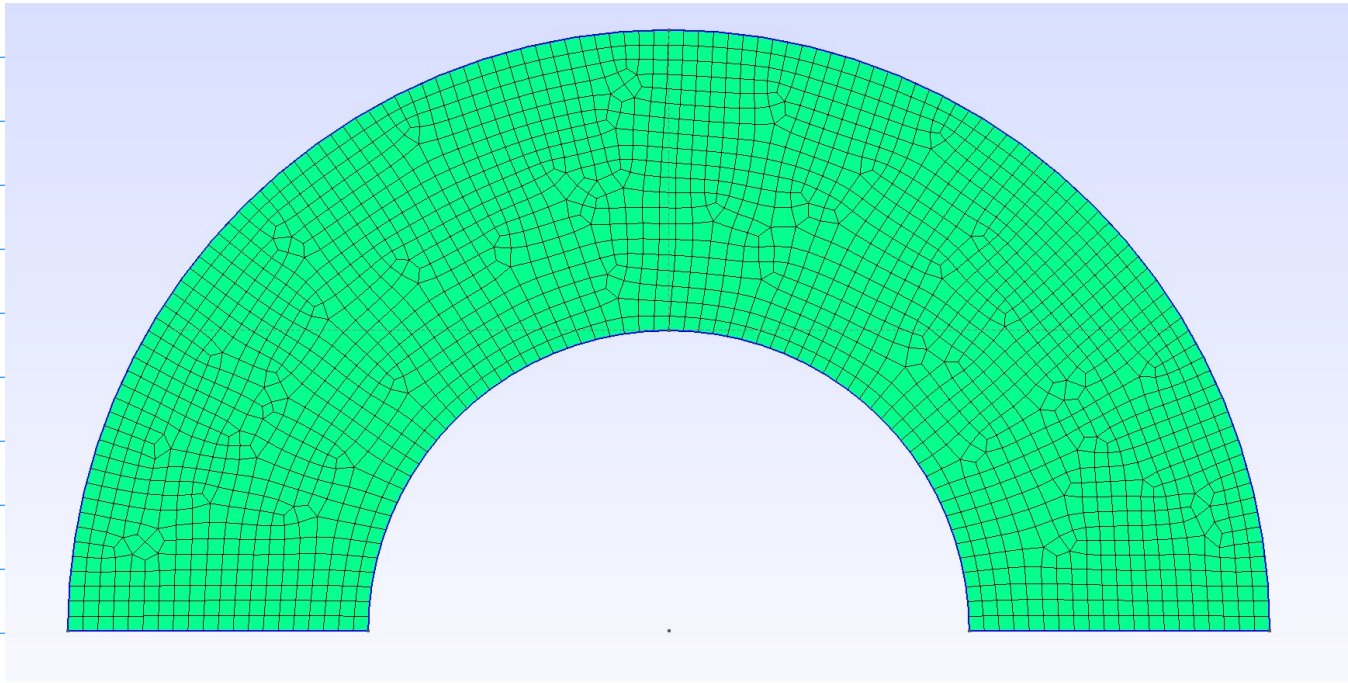
Attempt a 2D heat conduction problem for the purpose of getting a simple convection BC to work in FiPy.

Compare to analytical solution.



gmsh mesh.



Is this the right way to apply the convection BC?

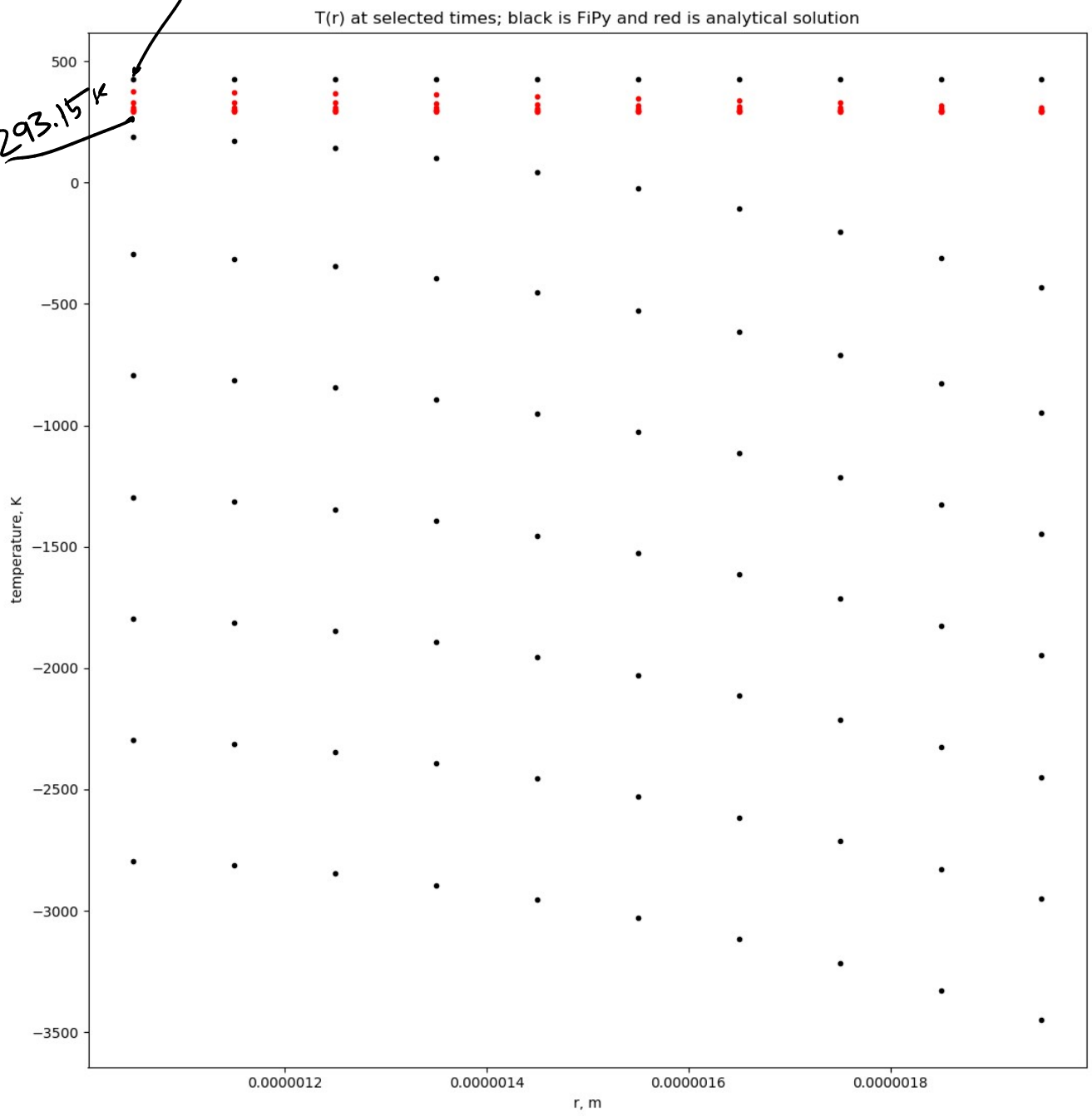
```
#convection boundary condition
var.faceGrad.constrain([-convectionCoeff/k*(var.faceValue-T_infinity)]*mesh.faceNormals,where=surfaceFaces)
```

Biot # = 10.0

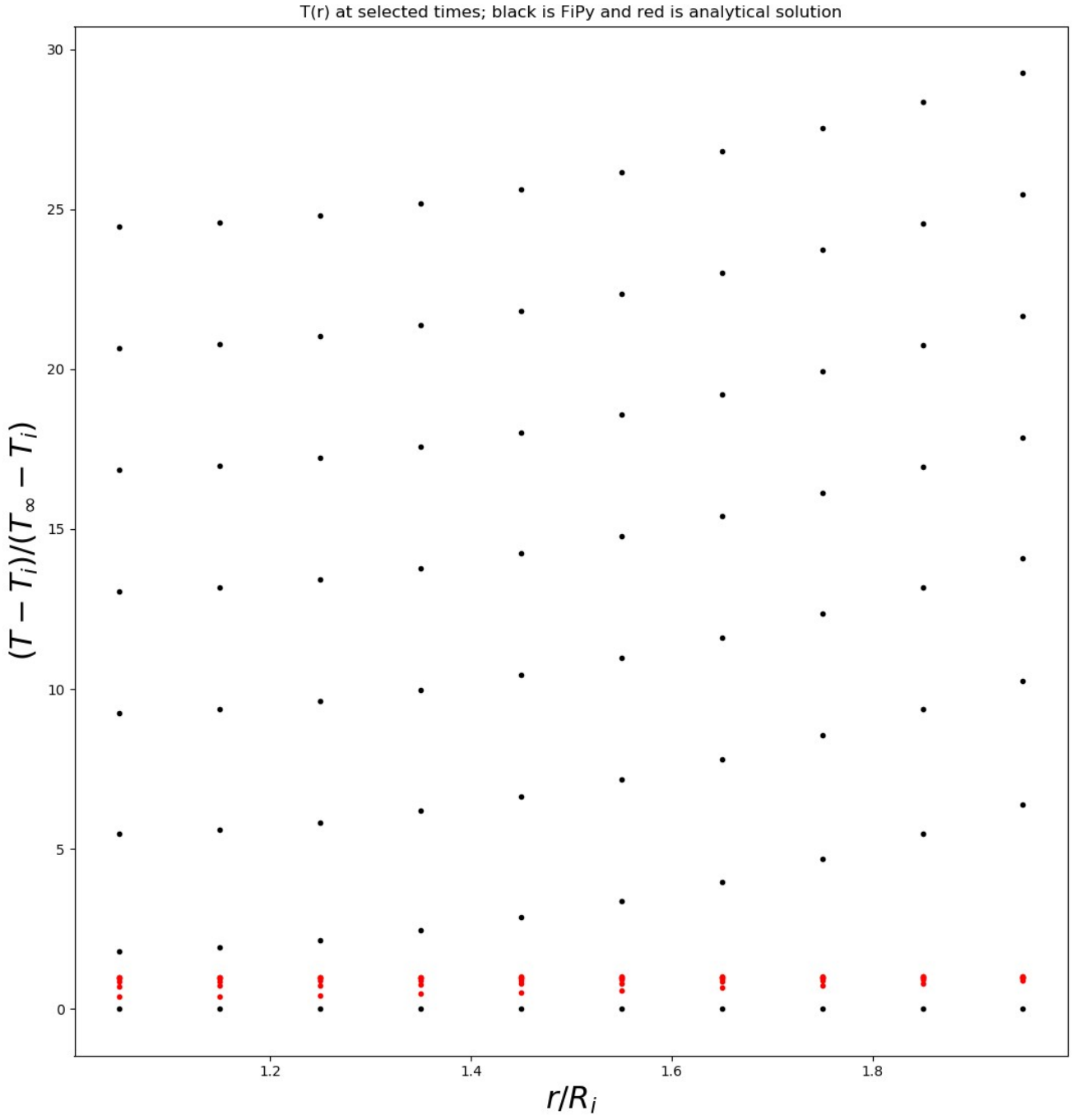
$$\frac{R_{outer}}{R_{inner}} = 2.0$$

$T_i = 425.08$ K

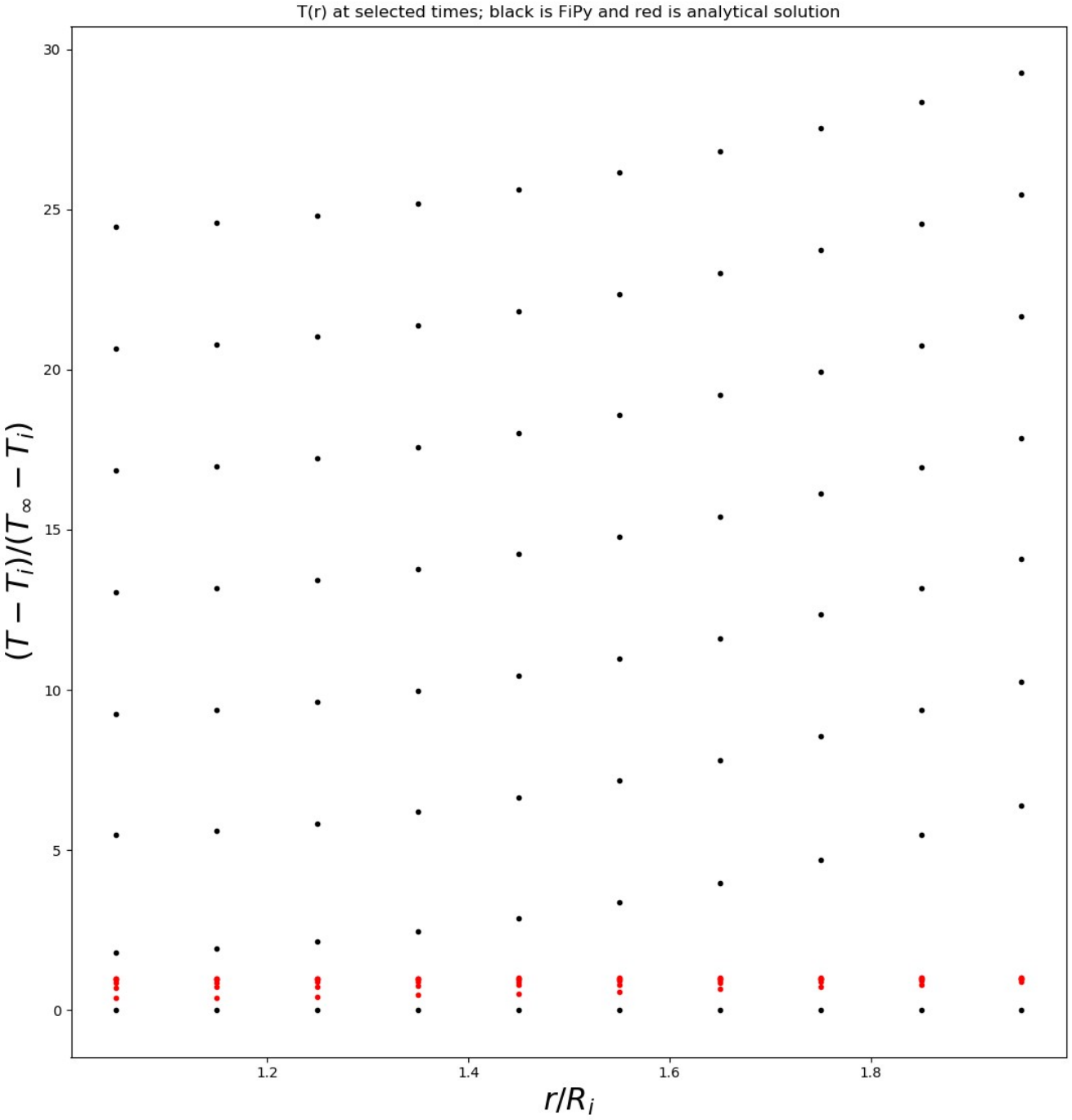
$T_\infty = 293.15$ K



Solved with dimensional rather than dimensionless variables. dt is .9 * explicit limit dt (see FiPy diffusion example # 1). FiPy result and analytical solution are far apart. FiPy result does not make physical sense.



Solved with dimensionless rather than dimensional variables. dt is .9 * explicit limit dt (see FiPy diffusion example #1). FiPy result and analytical solution are far apart. FiPy result does not make physical sense.



This time, sweeping is used.
Solved with dimensionless rather than dimensional variables. dt is .9 * explicit limit dt (see FiPy diffusion example #1). FiPy result and analytical solution are far apart. FiPy result does not make physical sense.

R23B01T0

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1. Problem description

This problem is for a homogeneous annulus of inner radius R_1 and the outer radius R_2. It is subjected to heating through convection with an environment temperature T_∞. The inner surface is insulated. At time t=0 temperature at every point inside the cylinder is 0.

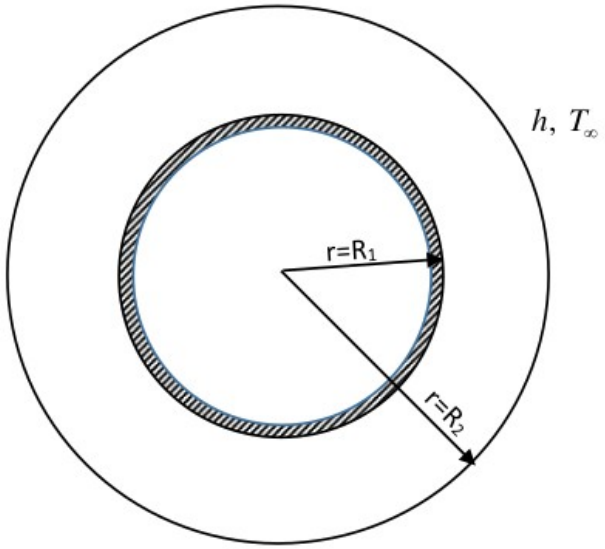

Figure 1. Schematic of R23B10T0 problem

Source of analytical solution in the form of mfiles for Matlab/Octave