Basic formulation of an axisymmetric problem

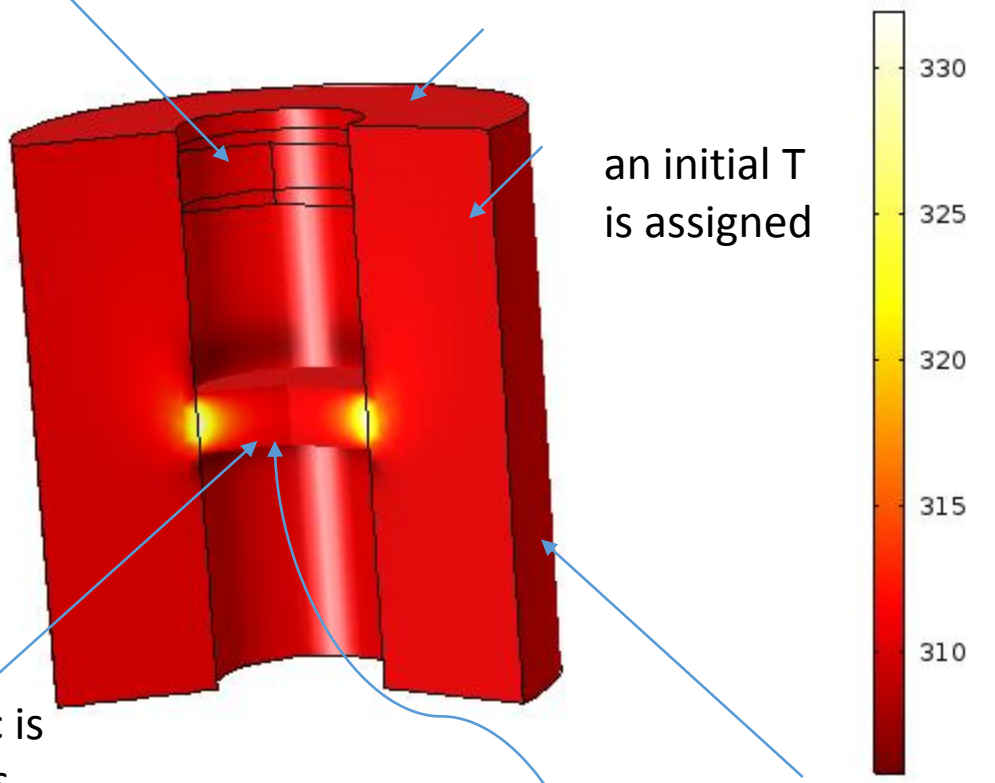
This is the starting location of a thin disc of metal, representing the tip of a drill bit that is cutting the surrounding material. The cutting releases heat energy at the boundary between the disc and surrounding material….

… and this heat is released via a “pair boundary heat source” in the Comsol model.

Via a moving mesh, the disc is shown here -- moved to this location at 2 seconds after the start. (The moving mesh is assigned a velocity to make this occur.)

top & bottom surfaces of cylinder have a conductive heat transfer condition

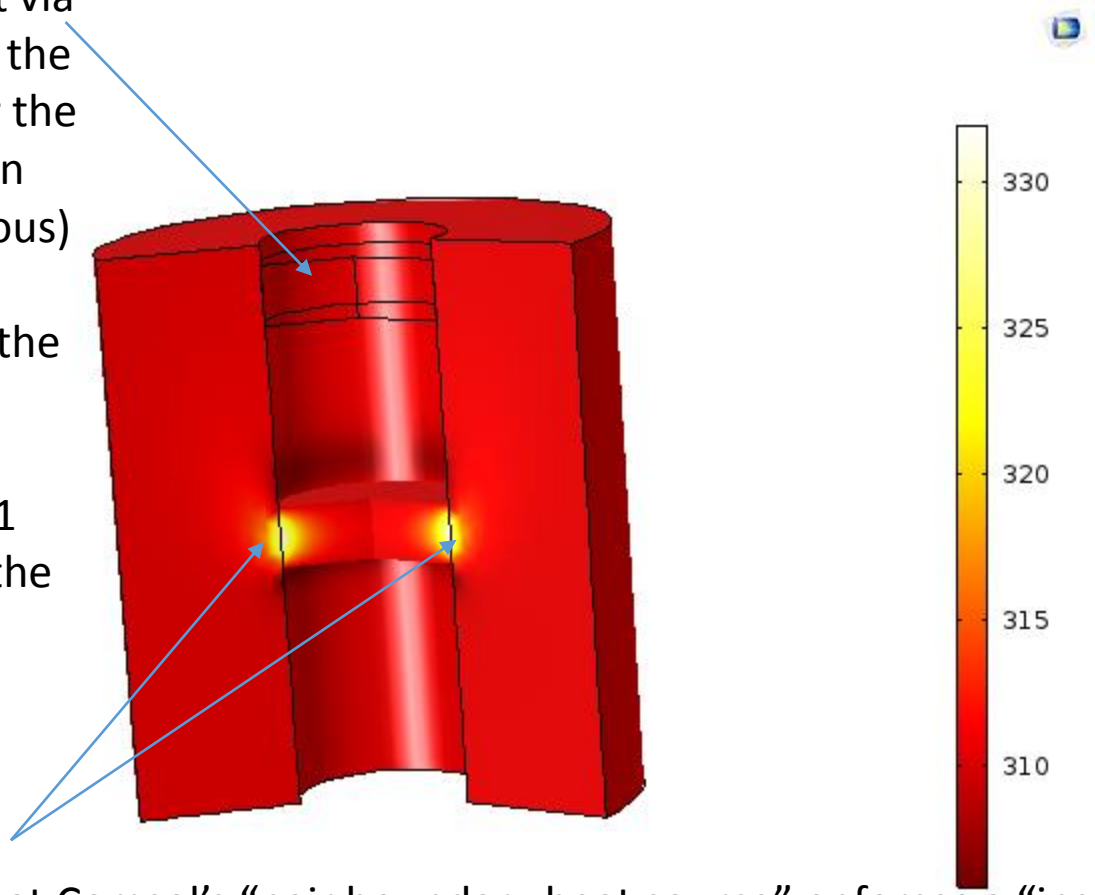
an initial T is assigned



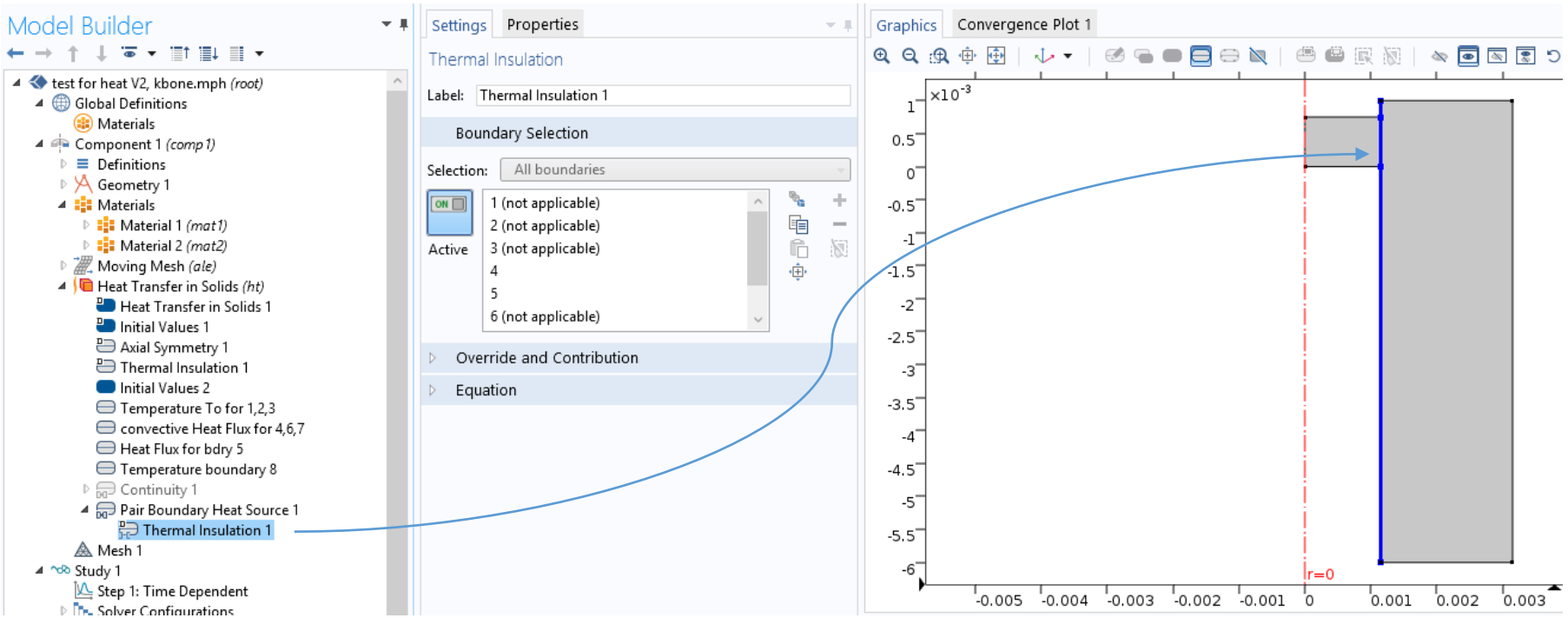
Outer surface of cylinder is maintained at 310 deg K, and so are the top and bottom surfaces of the thin disc.

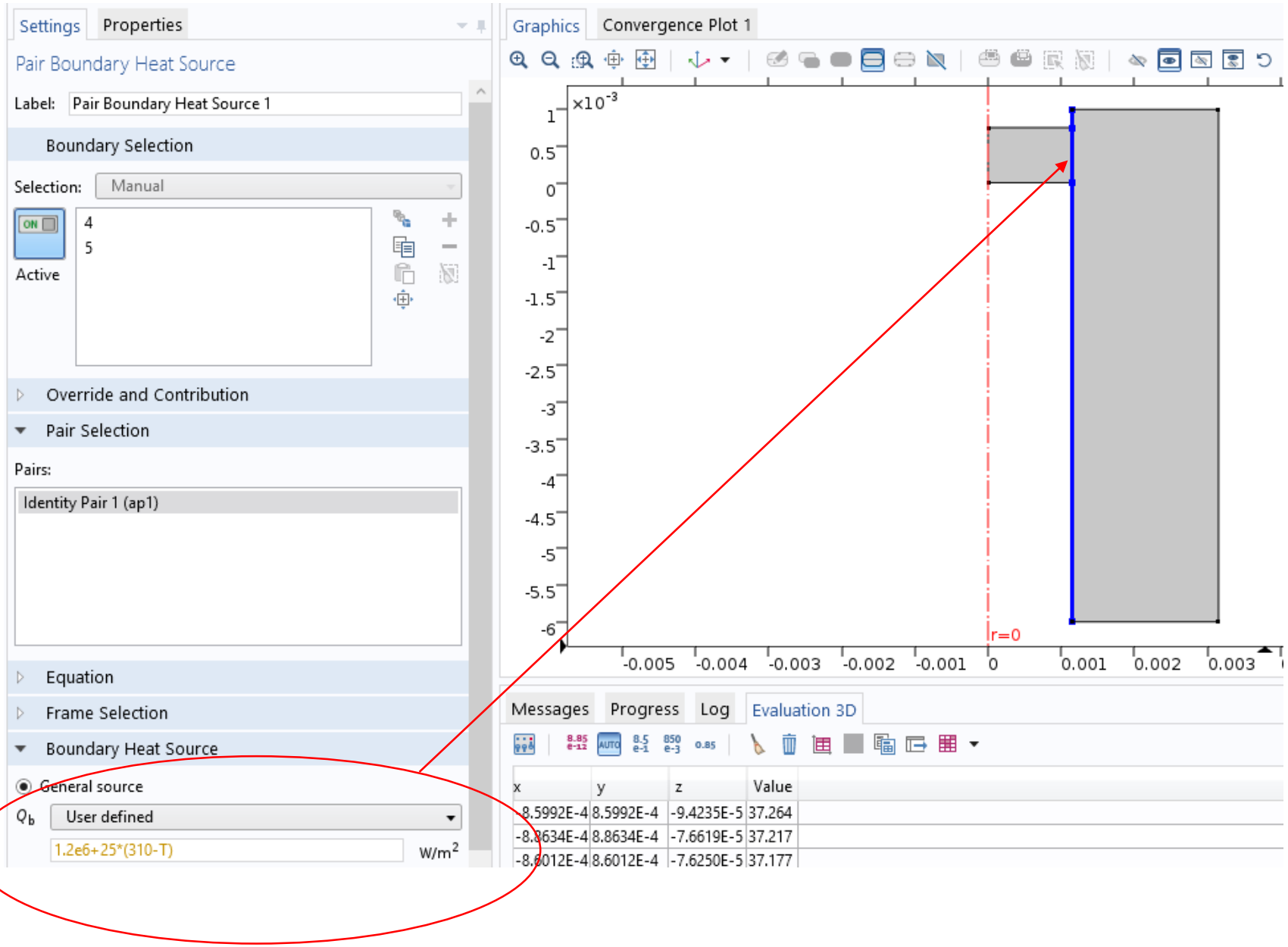
Questions

As the disc moves from one location to the next via the moving mesh, does the "n+1" solution consider the temperature distribution caused by "n th" (previous) solution? Or does the "n+1" solution just use the original (t=0) set of conditions? It does not look (to me) like the n+1 solution is considering the previous history. (??) I would like it to. How would I do that?



By default, it appears that Comsol's "pair boundary heat source" enforces a "insulated" condition at the pair boundary (see slide 3). This is a confusing since the heat source seems to be transferring heat to the surrounding material across the boundary, as expected, so how could that pair boundary be insulated? Also, in my "user defined" assignment of the "pair boundary heat source" (see slide 4) I have a source plus a flux. Is this OK?


Model Builder
test for heat V2, kbone.mph (root)
Global Definitions
Materials
Component 1 (comp 1)
Definitions
Geometry 1
Materials
Material 1 (mat1)
Material 2 (mat2)
Moving Mesh (ale)
Heat Transfer in Solids (ht)
Heat Transfer in Solids 1
Initial Values 1
Axial Symmetry 1
Thermal Insulation 1
Initial Values 2
Temperature To for 1,2,3
convective Heat Flux for 4,6,7
Heat Flux for bdry 5
Temperature boundary 8
Continuity 1
Pair Boundary Heat Source 1
Thermal Insulation 1
Mesh 1
Study 1
Step 1: Time Dependent
Solver Configurations
Settings
Properties
Thermal Insulation
Label: Thermal Insulation 1
Boundary Selection
Selection: All boundaries
ON
Active
1 (not applicable)
2 (not applicable)
3 (not applicable)
4
5
6 (not applicable)
Override and Contribution
Equation
Graphics
Convergence Plot 1
×10-3
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
r=0
-0.005
-0.004
-0.003
-0.002
-0.001
0
0.001
0.002
0.003


Settings
Properties
Pair Boundary Heat Source
Label: Pair Boundary Heat Source 1
Boundary Selection
Selection: Manual
ON
Active
4
5
Override and Contribution
Pair Selection
Pairs:
Identity Pair 1 (ap1)
Equation
Frame Selection
Boundary Heat Source
General source
Q_b
User defined
1.2e6+25*(310-T)
W/m^2
Graphics
Convergence Plot 1
×10^{-3}
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
r=0
-0.005
-0.004
-0.003
-0.002
-0.001
0
0.001
0.002
0.003
Messages
Progress
Log
Evaluation 3D
x
y
z
Value
8.5992E-4
8.5992E-4
-9.4235E-5
37.264
-8.8634E-4
8.8634E-4
-7.6619E-5
37.217
-8.6012E-4
8.6012E-4
-7.6250E-5
37.177