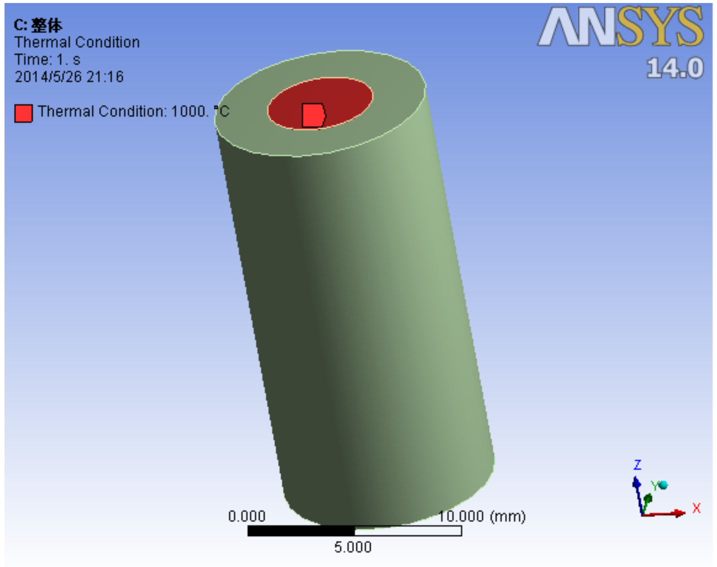
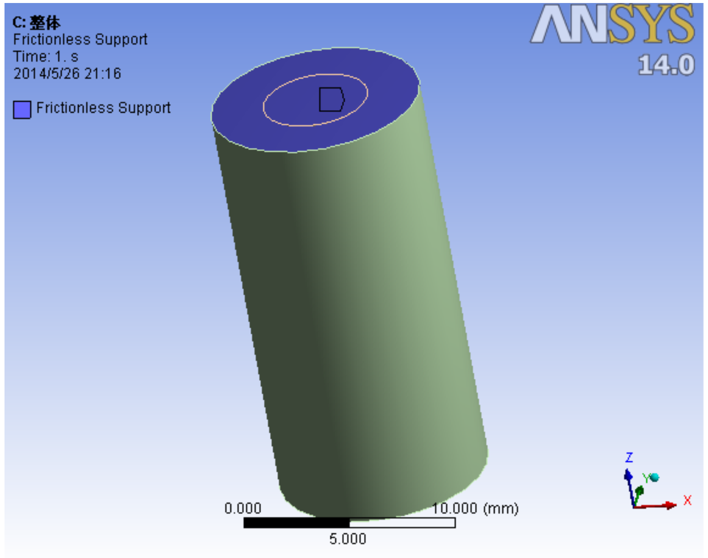
Sample Calculation by ANSYS Workbench

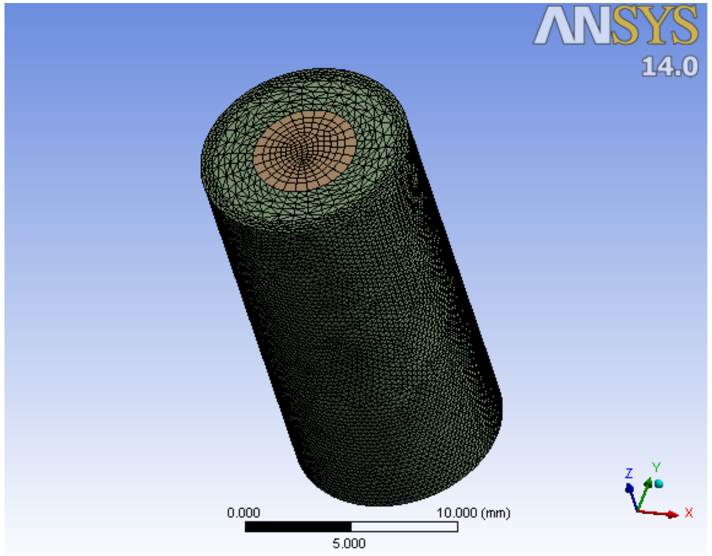
Song JIN

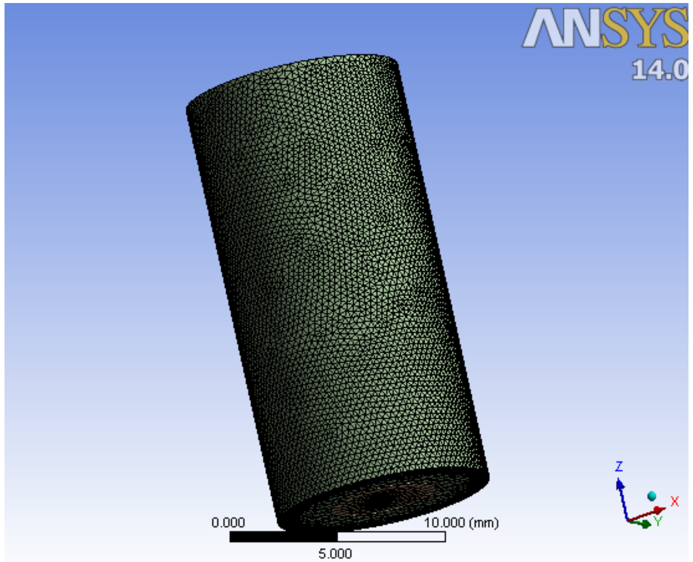
2012-5-25

1) Boundary and Meshing

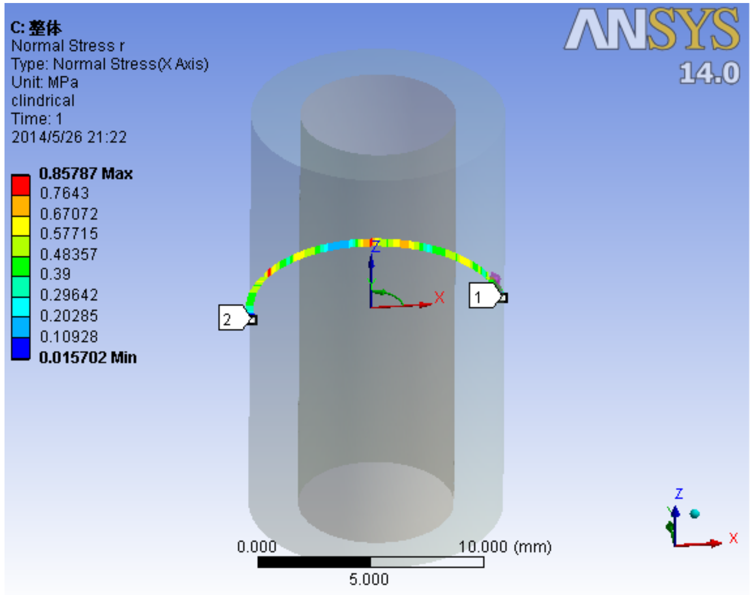


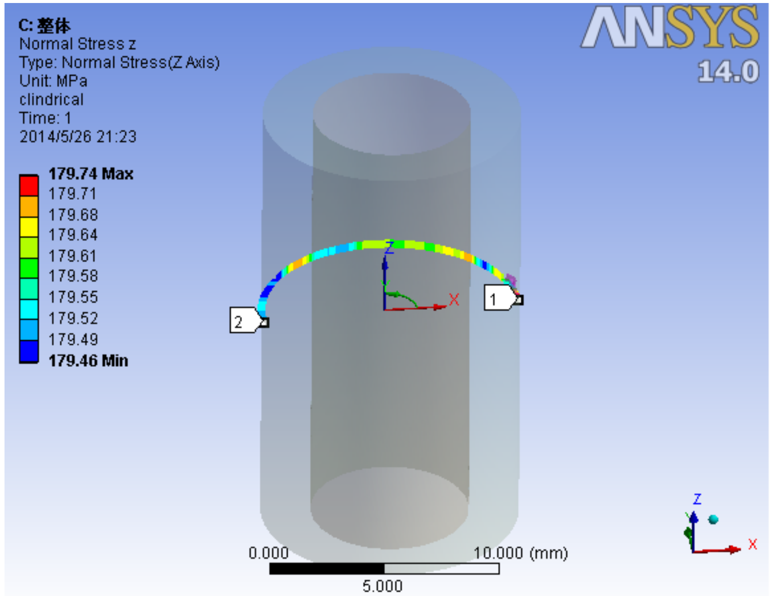


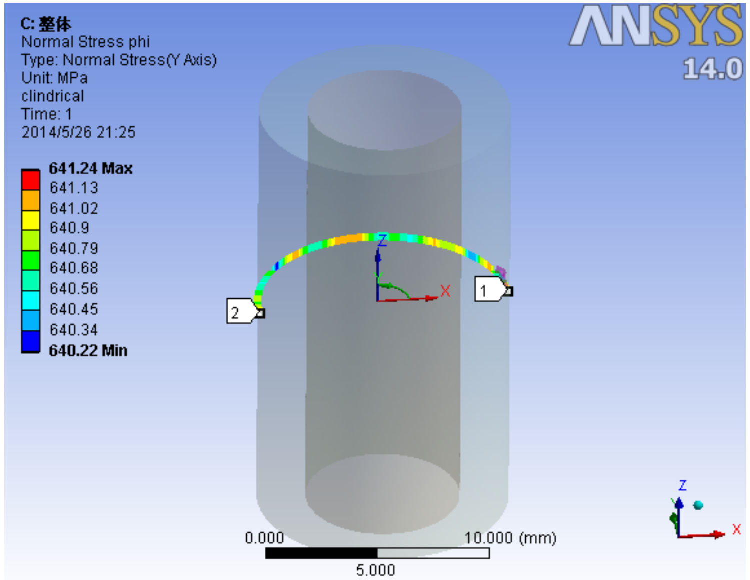


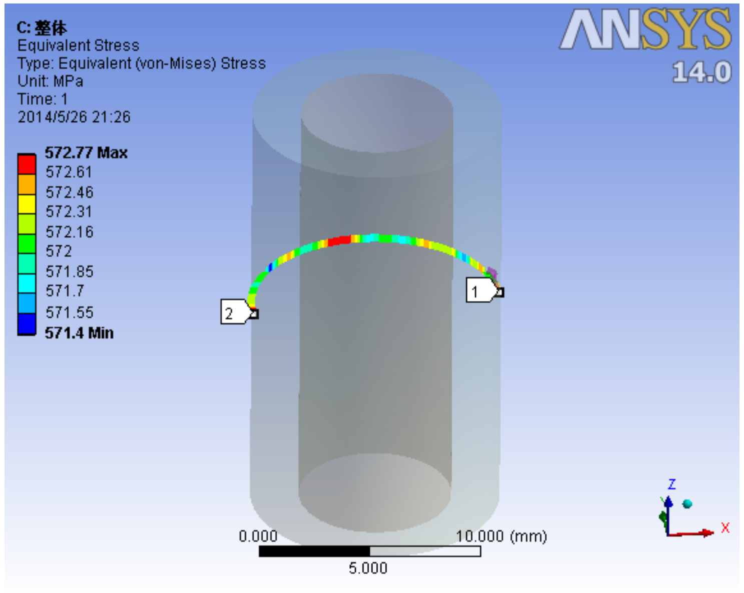


Results

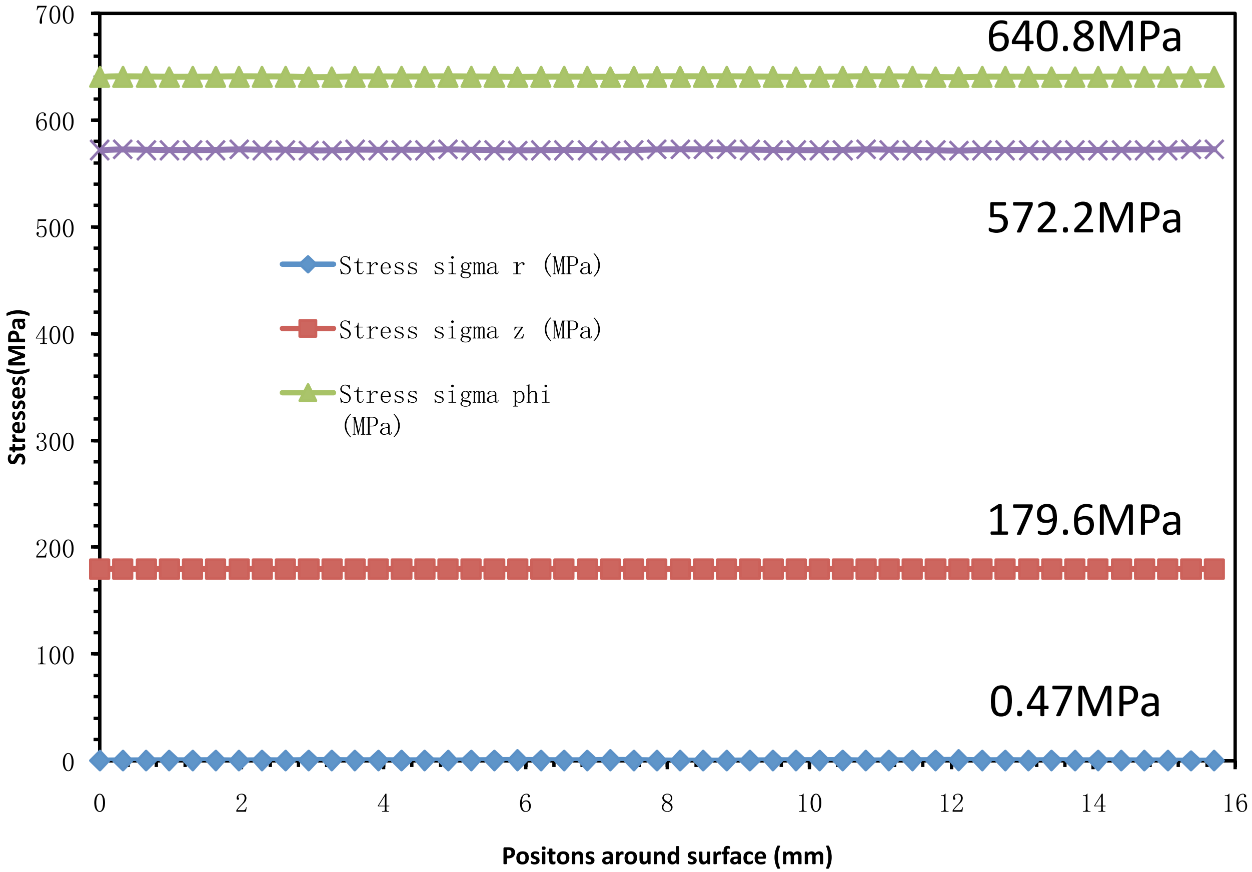

C: 整体
Normal Stress r
Type: Normal Stress(X Axis)
Unit: MPa
clindrical
Time: 1
2014/5/26 21:22
0.85787 Max
0.7643
0.67072
0.57715
0.48357
0.39
0.29642
0.20285
0.10928
0.015702 Min
ANSYS
14.0
0.000
10.000 (mm)
5.000


C: 整体
Normal Stress z
Type: Normal Stress(Z Axis)
Unit: MPa
clindrical
Time: 1
2014/5/26 21:23
179.74 Max
179.71
179.68
179.64
179.61
179.58
179.55
179.52
179.49
179.46 Min
ANSYS
14.0
0.000
10.000 (mm)
5.000

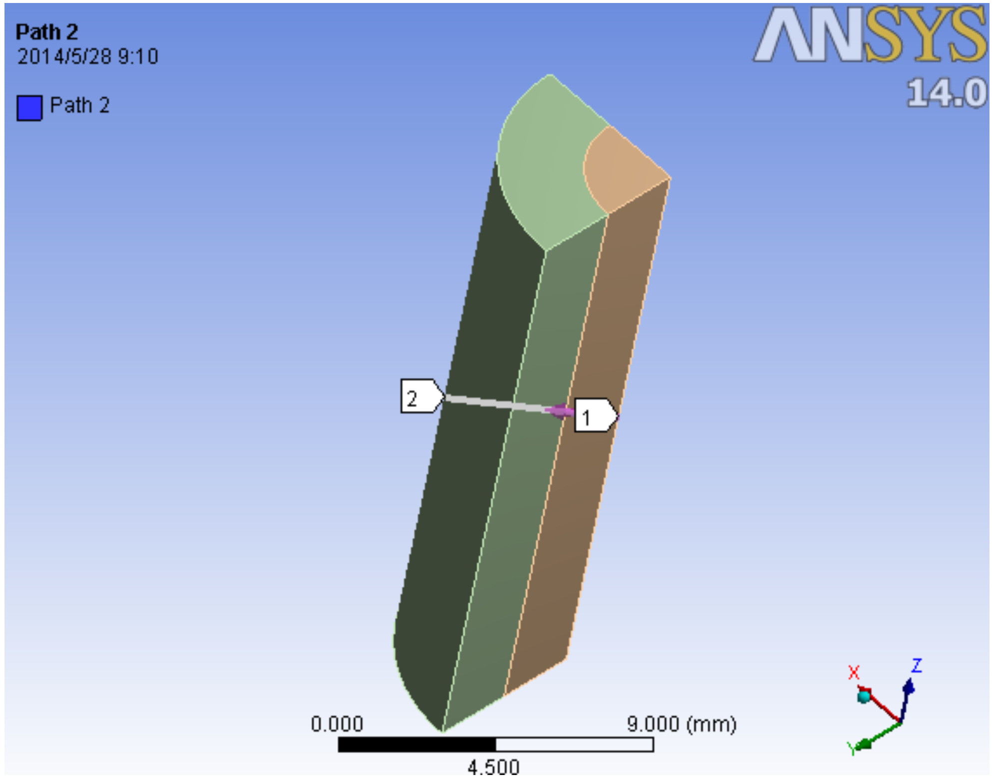

C: 整体
Normal Stress phi
Type: Normal Stress(Y Axis)
Unit: MPa
clindrical
Time: 1
2014/5/26 21:25
641.24 Max
641.13
641.02
640.9
640.79
640.68
640.56
640.45
640.34
640.22 Min
ANSYS
14.0
0.000
10.000 (mm)
5.000


C: 整体
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 1
2014/5/26 21:26
572.77 Max
572.61
572.46
572.31
572.16
572
571.85
571.7
571.55
571.4 Min
ANSYS
14.0
0.000
10.000 (mm)
5.000

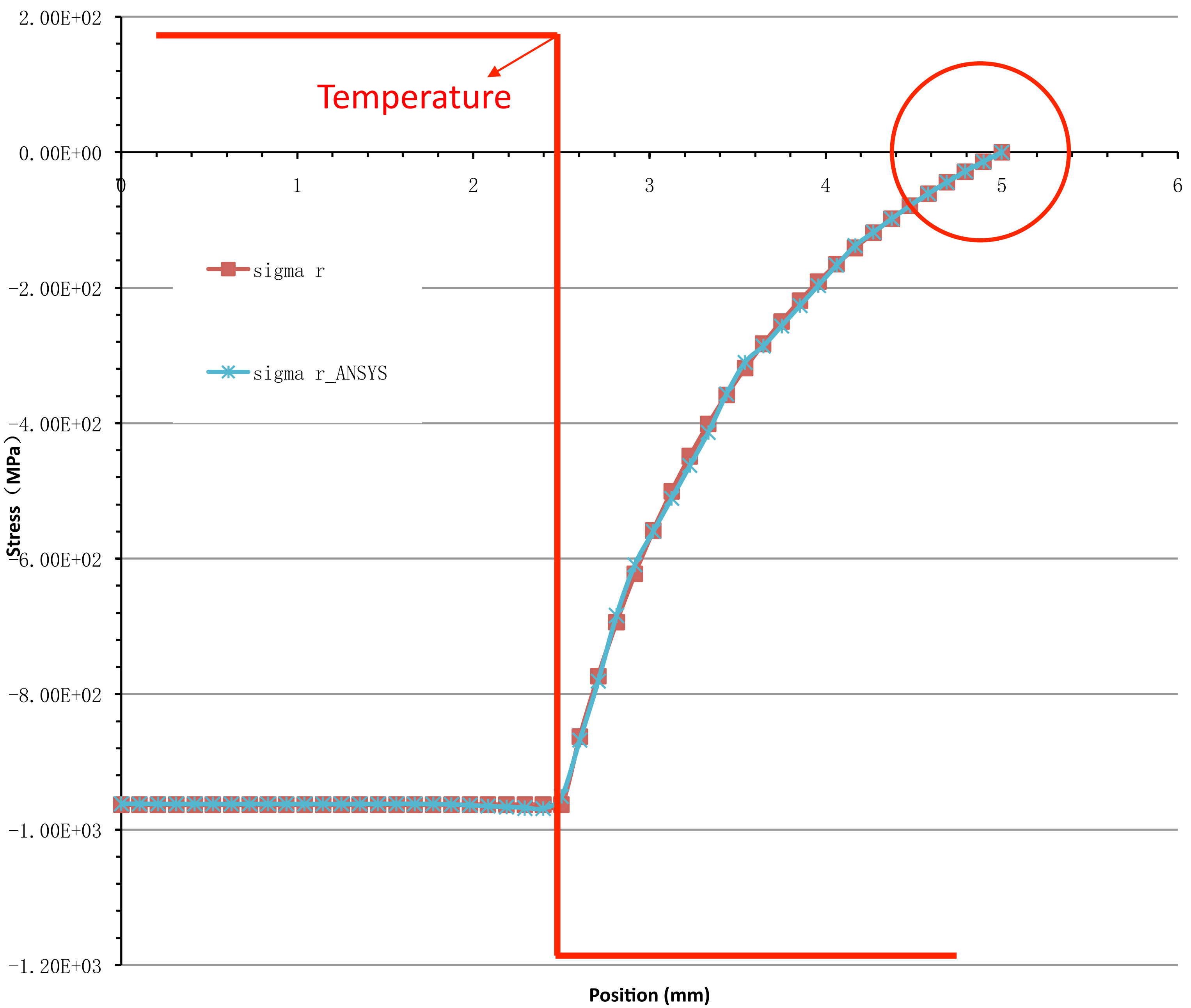
Results Cont.



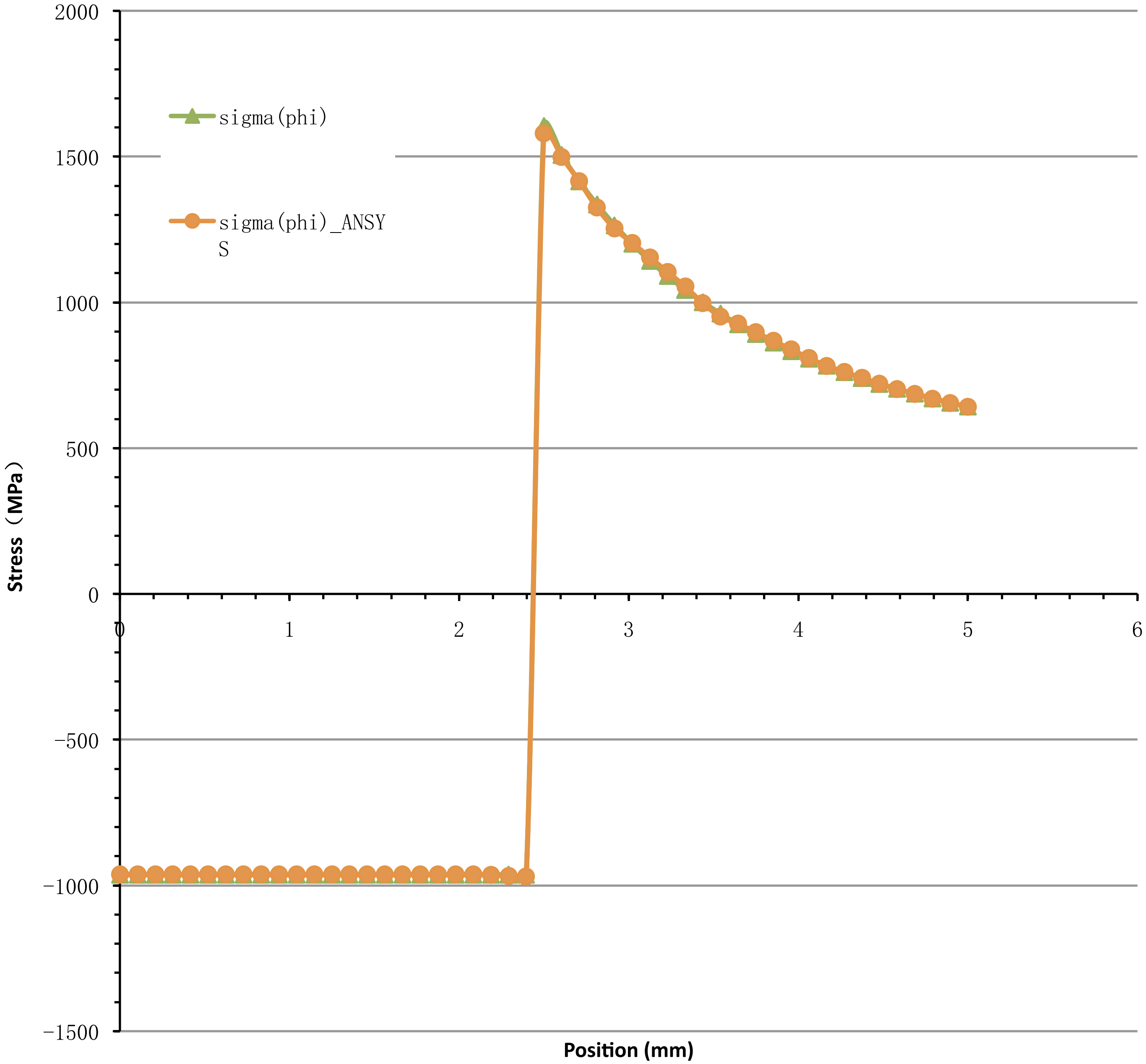
Results at radial direction



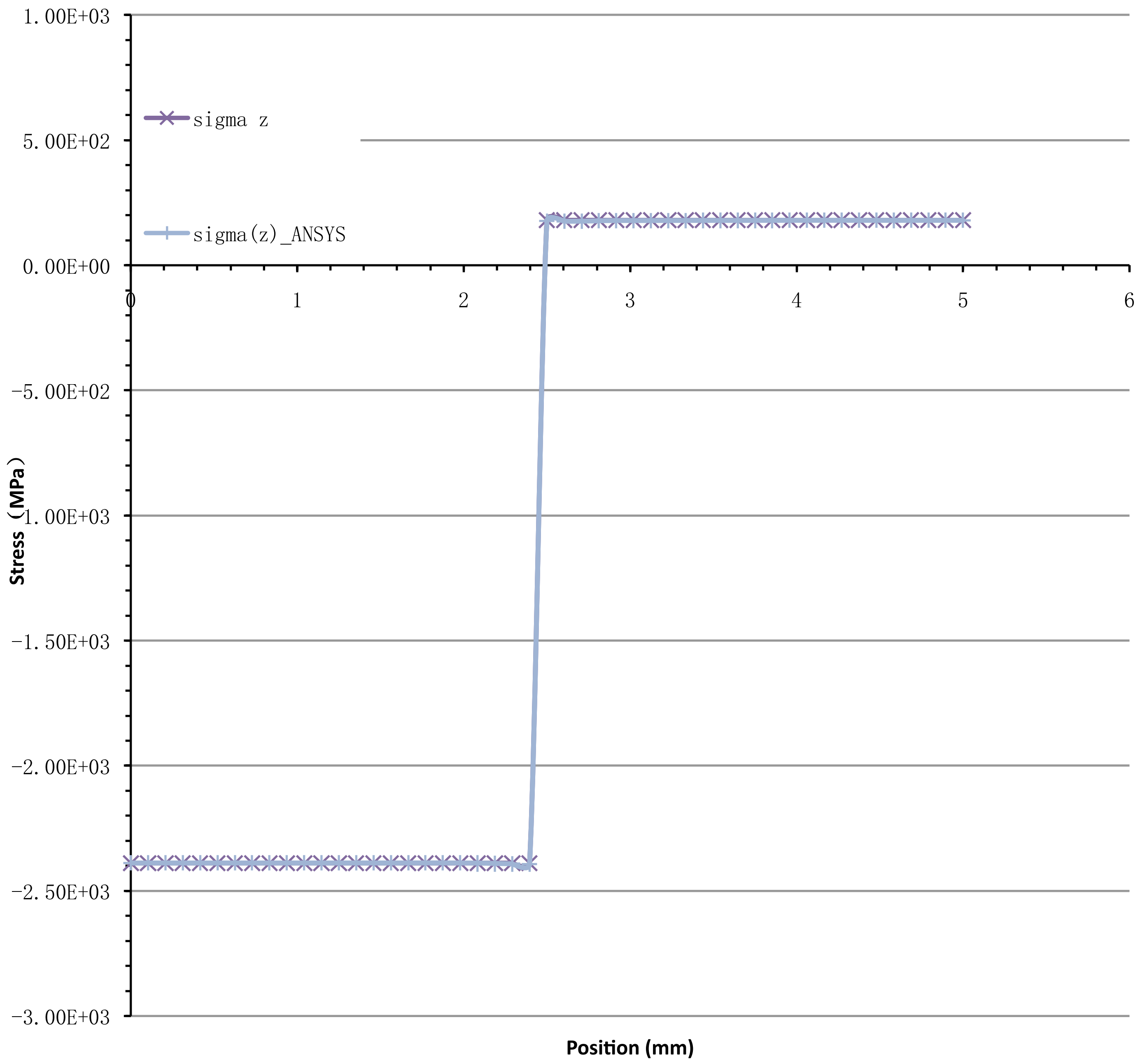
1) Stress sigma r
2) Stress sigma phi
3) Stress sigma z
4) V. M. Stress
5) U (displacement)



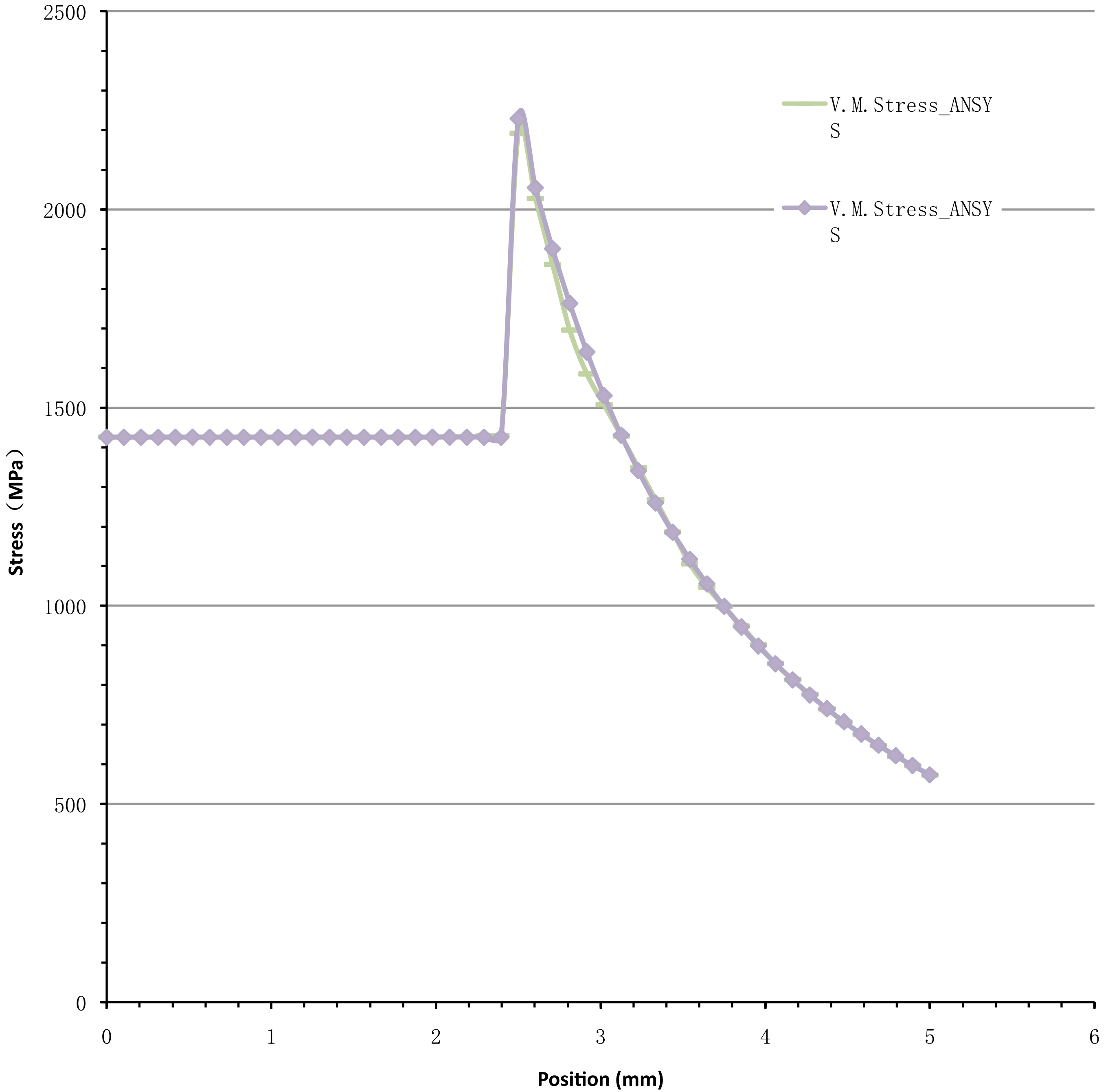
2.00E+02
0.00E+00
-2.00E+02
-4.00E+02
-6.00E+02
-8.00E+02
-1.00E+03
-1.20E+03
0
1
2
3
4
5
6
Temperature
sigma r
sigma r_ANSYS
Stress（MPa）
Position (mm)

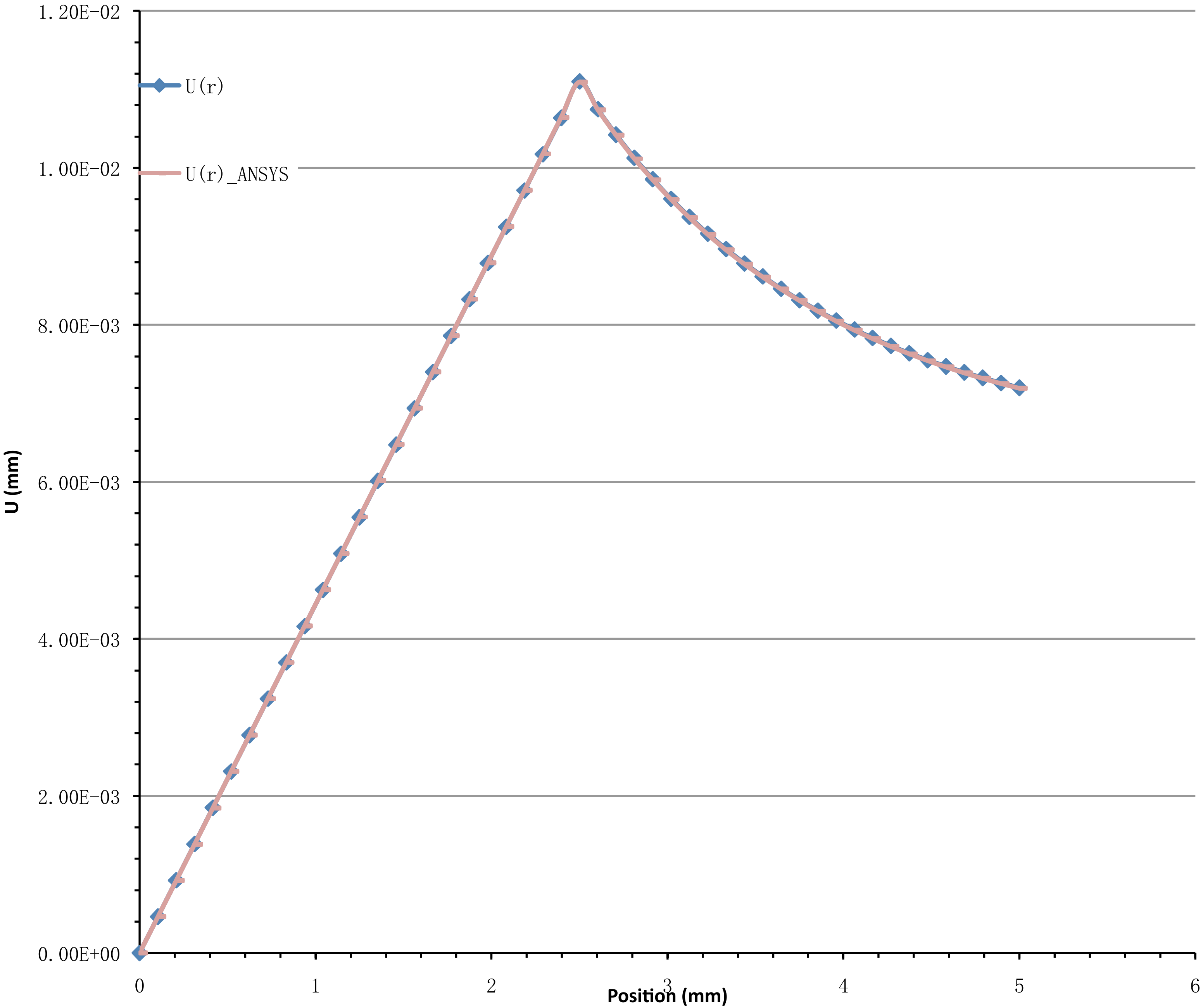


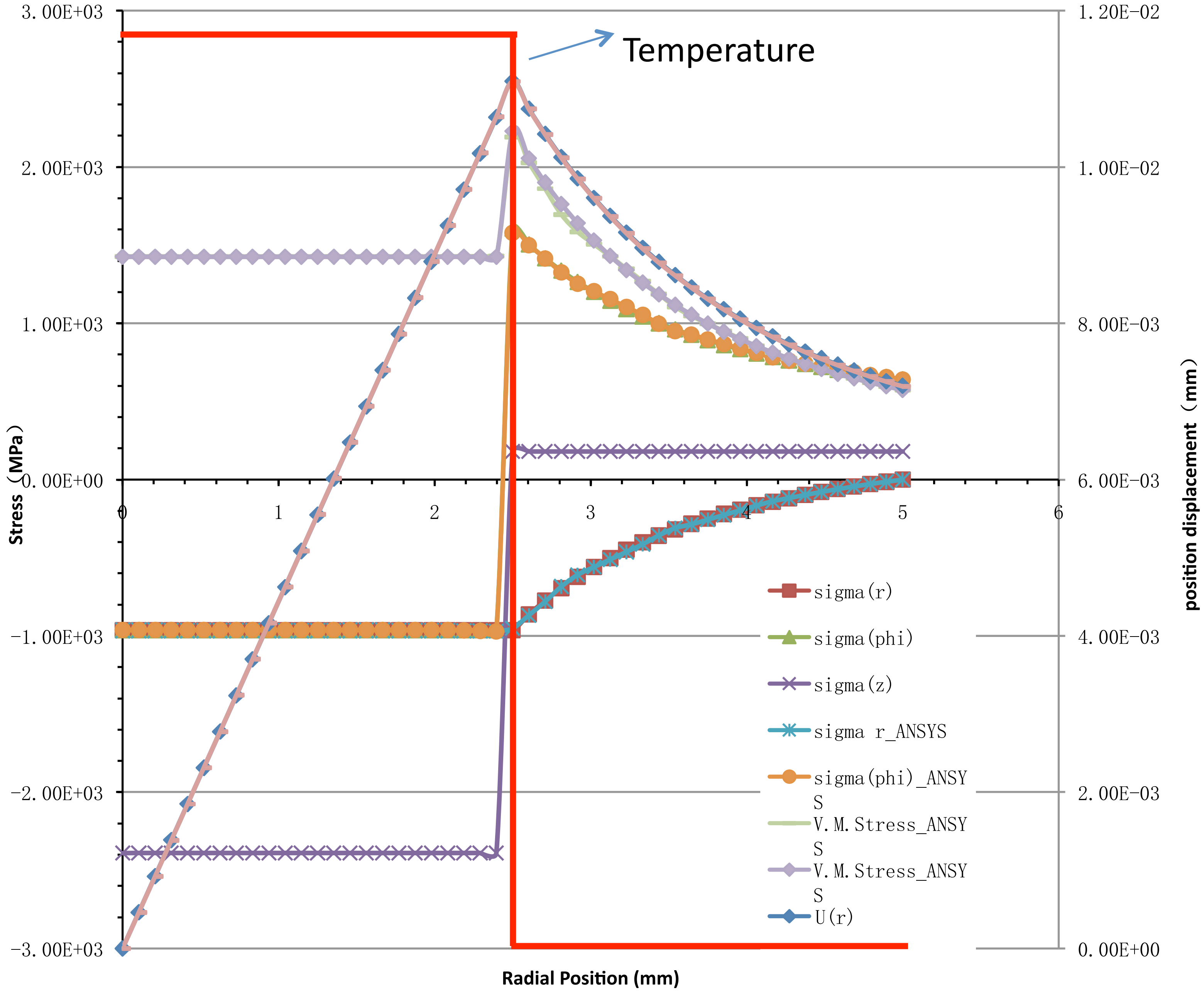
2000
1500
1000
500
0
-500
-1000
-1500
Stress（MPa）
0
1
2
3
4
5
6
Position (mm)
sigma(phi)
sigma(phi)_ANSYS



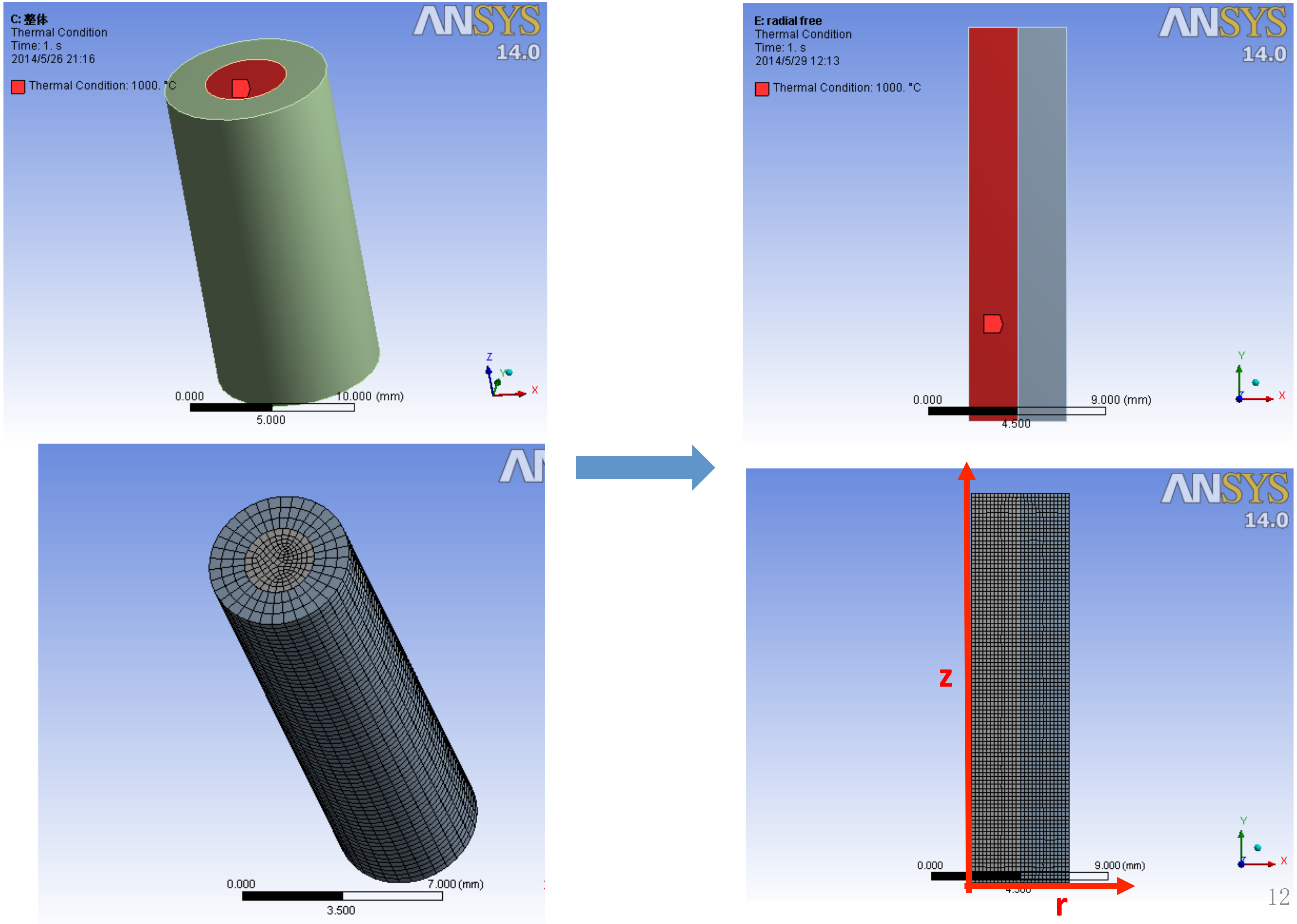
1.00E+03
5.00E+02
0.00E+00
-5.00E+02
-1.00E+03
-1.50E+03
-2.00E+03
-2.50E+03
-3.00E+03
0
1
2
3
4
5
6
sigma z
sigma(z)_ANSYS
Stress（MPa）
Position (mm)


2500
2000
1500
1000
500
0
Stress（MPa）
0
1
2
3
4
5
6
Position (mm)
V.M.Stress_ANSYS
V.M.Stress_ANSYS


1.20E-02
1.00E-02
8.00E-03
6.00E-03
4.00E-03
2.00E-03
0.00E+00
U (mm)
U(r)
U(r)_ANSYS
0
1
2
3
4
5
6
Position (mm)


Temperature
3.00E+03
2.00E+03
1.00E+03
0.00E+00
-1.00E+03
-2.00E+03
-3.00E+03
1.20E-02
1.00E-02
8.00E-03
6.00E-03
4.00E-03
2.00E-03
0.00E+00
0
1
2
3
4
5
6
Stress（MPa）
position displacement（mm）
Radial Position (mm)
sigma(r)
sigma(phi)
sigma(z)
sigma r_ANSYS
sigma(phi)_ANSYS
V.M.Stress_ANSYS
V.M.Stress_ANSYS
U(r)

2) Model Optimization

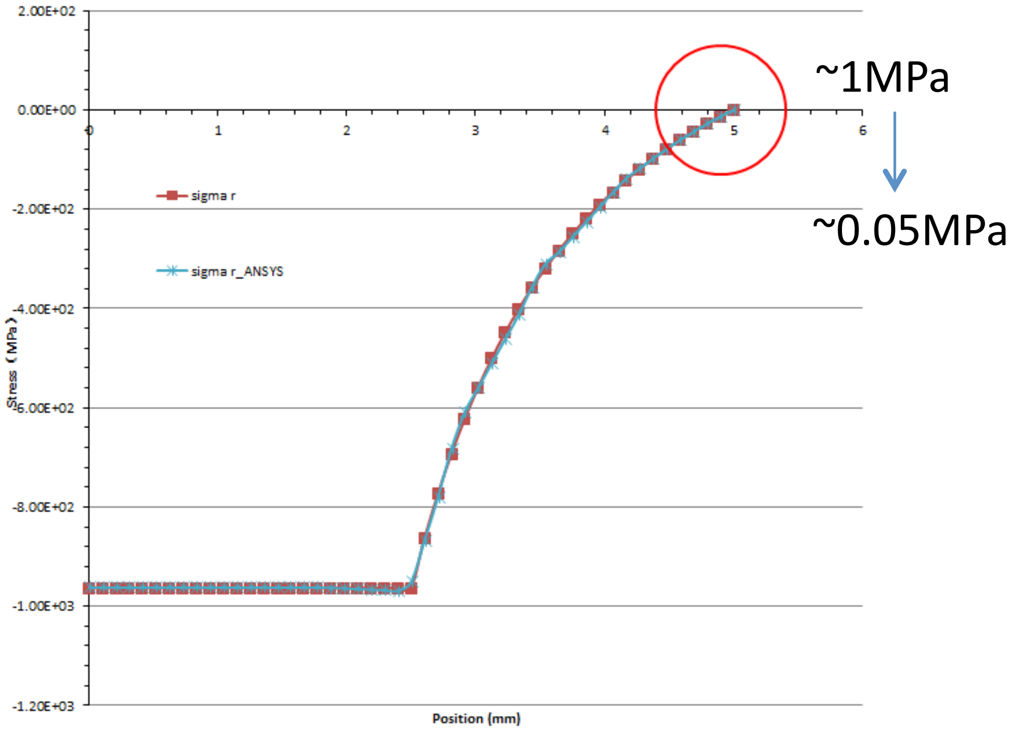


Results Comparison

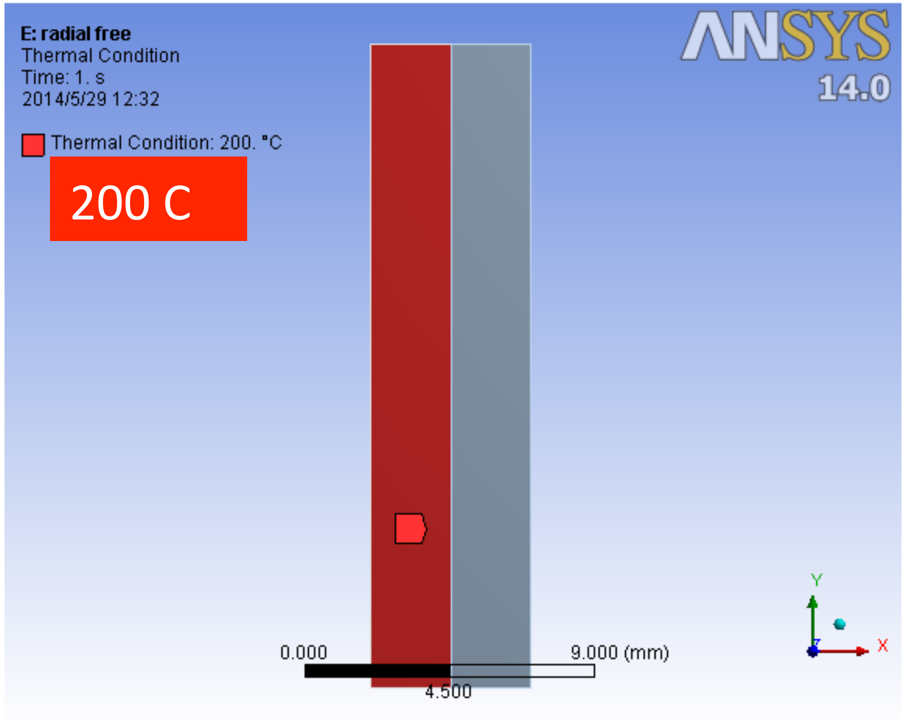
1) Accuracy

2) CPU time

For example:

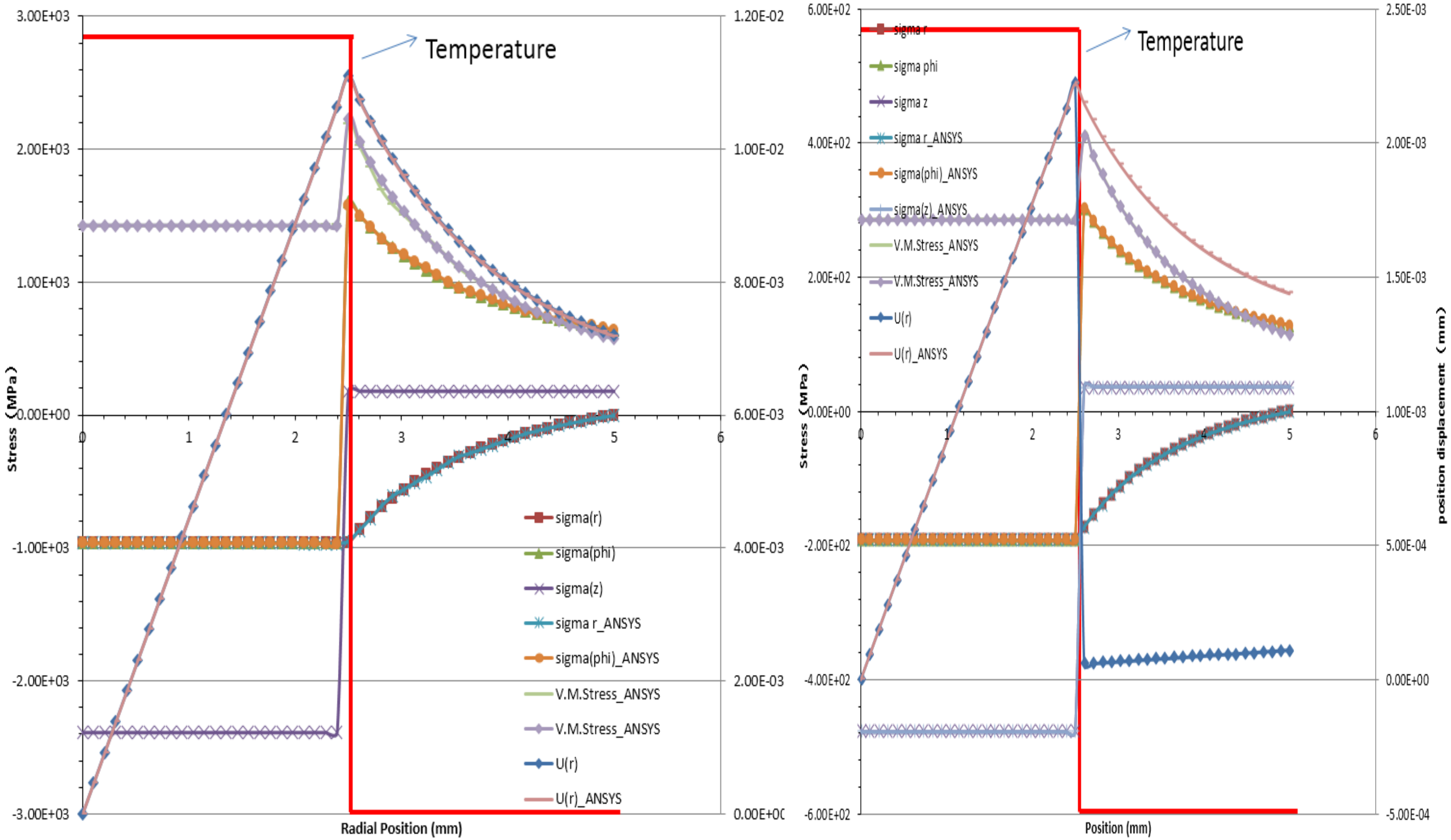


3) Make the Temperature 200C instead of 1000C since 200C is a reasonable value. Also axially constrained.



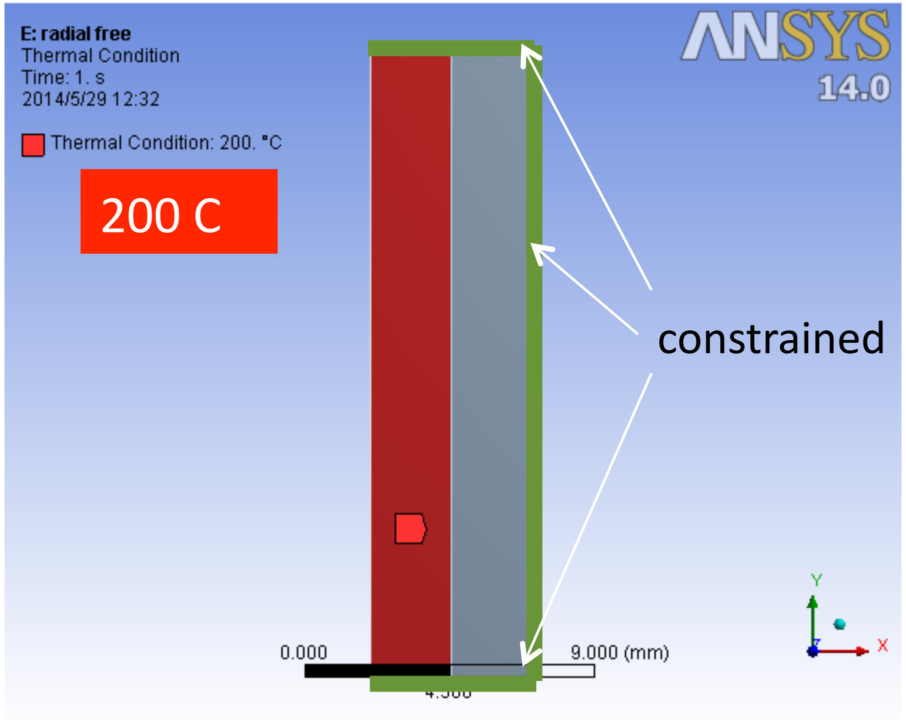
Parameters:

1. Tungsten cylinder, 10 mm diameter, 20 mm length;
2. Temperature=T=200C(in the radial region r=zero to r=2.5 mm , temperature zero between r=2.5 mm and r=5mm.



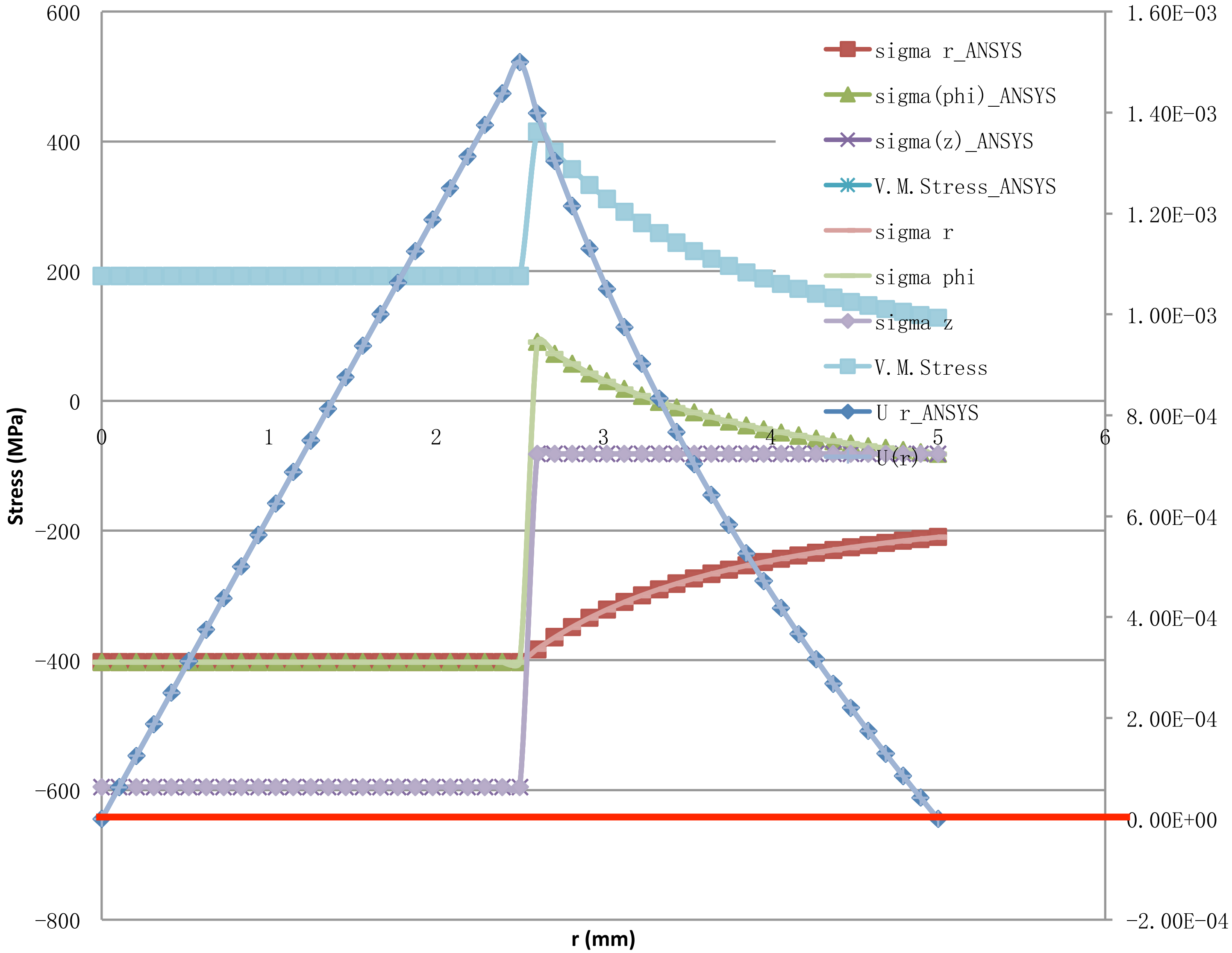
Still include both the ANSYS simulation results and analytic results. Just a has a scaling change

4) Change the boundary condition radially free to radially constrained. Also axially constrained in the same time.

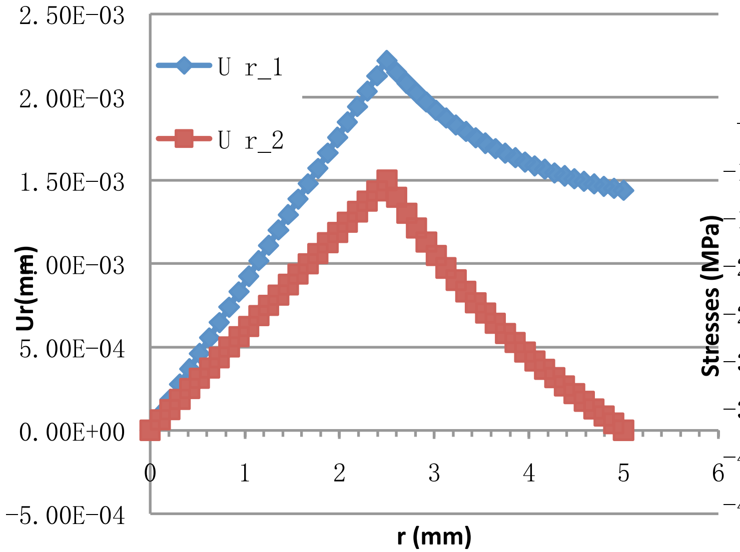


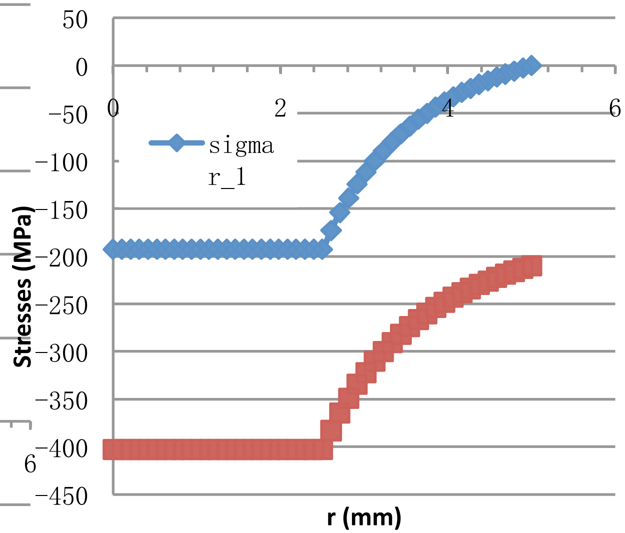
Parameters:

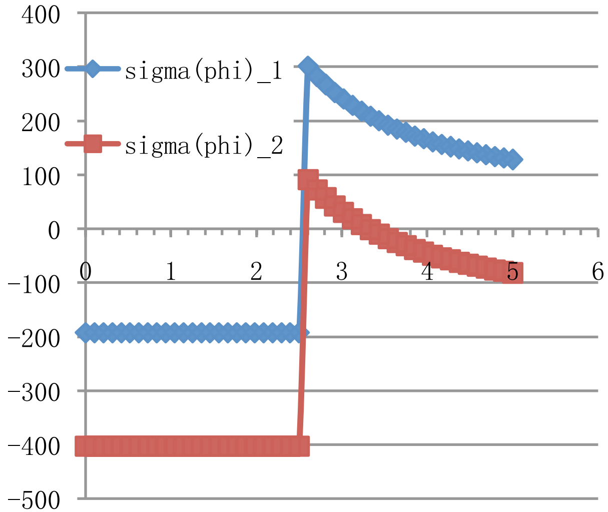
1. Tungsten cylinder, 10 mm diameter, 20 mm length;
2. Temperature=T=200C(in the radial region r=zero to r=2.5 mm , temperature zero between r=2.5 mm and r=5mm.

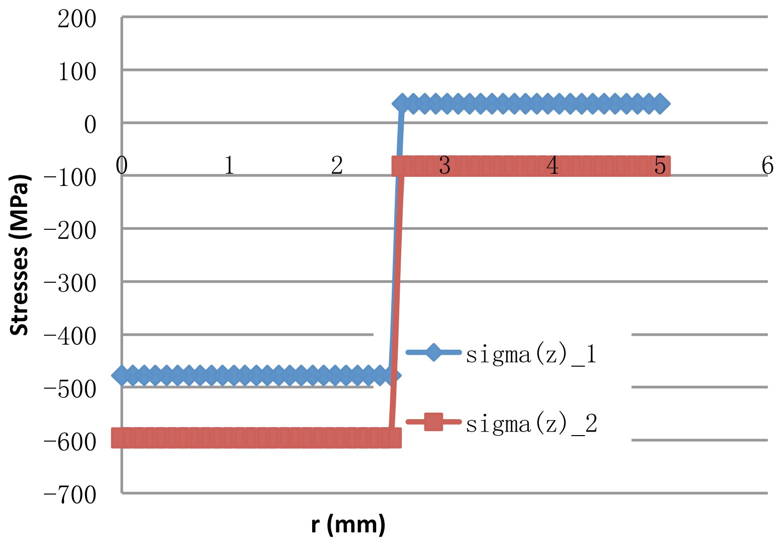

600
400
200
0
-200
-400
-600
-800
Stress (MPa)
0
1
2
3
4
5
6
r (mm)
1.60E-03
1.40E-03
1.20E-03
1.00E-03
8.00E-04
6.00E-04
4.00E-04
2.00E-04
0.00E+00
-2.00E-04
sigma r_ANSYS
sigma(phi)_ANSYS
sigma(z)_ANSYS
V.M.Stress_ANSYS
sigma r
sigma phi
sigma z
V.M.Stress
U r_ANSYS
U(r)

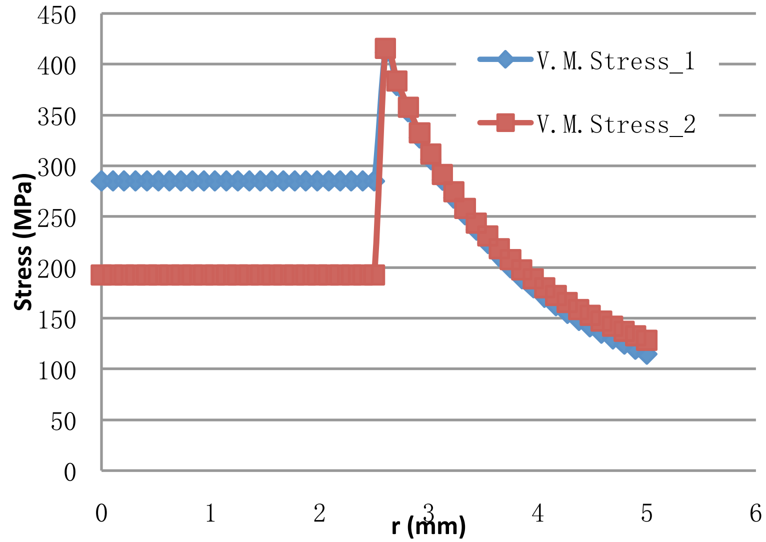
Comparison of the two boundaries



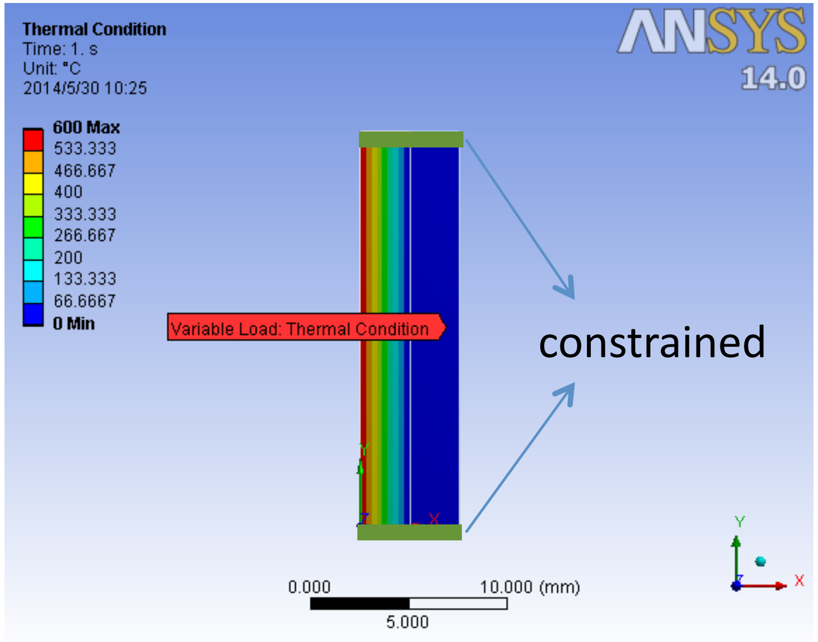


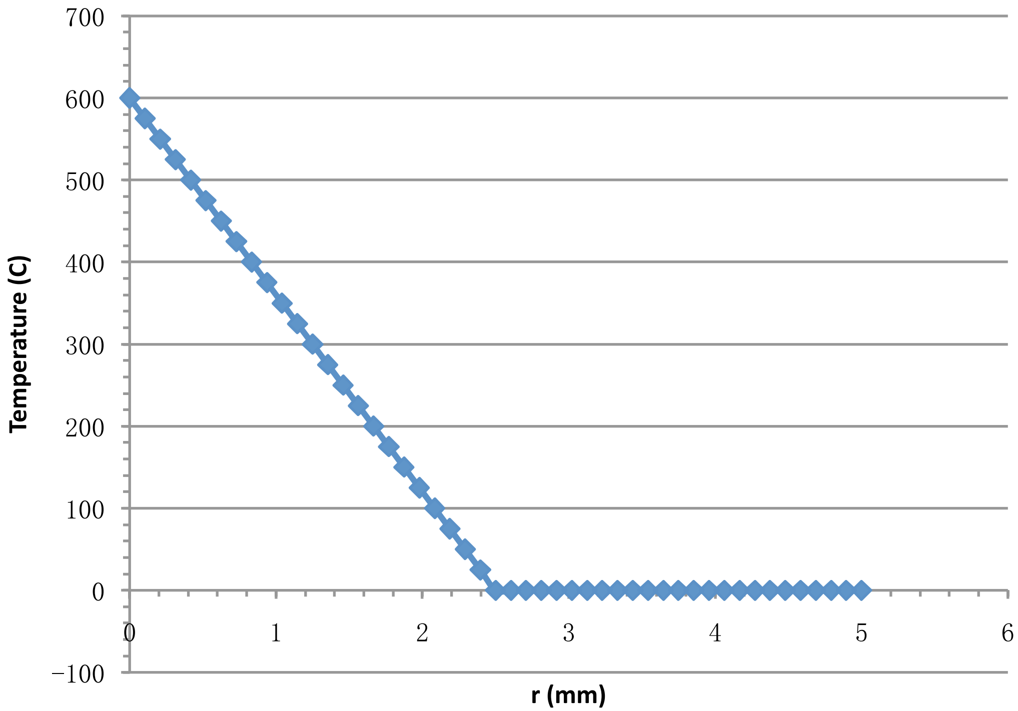


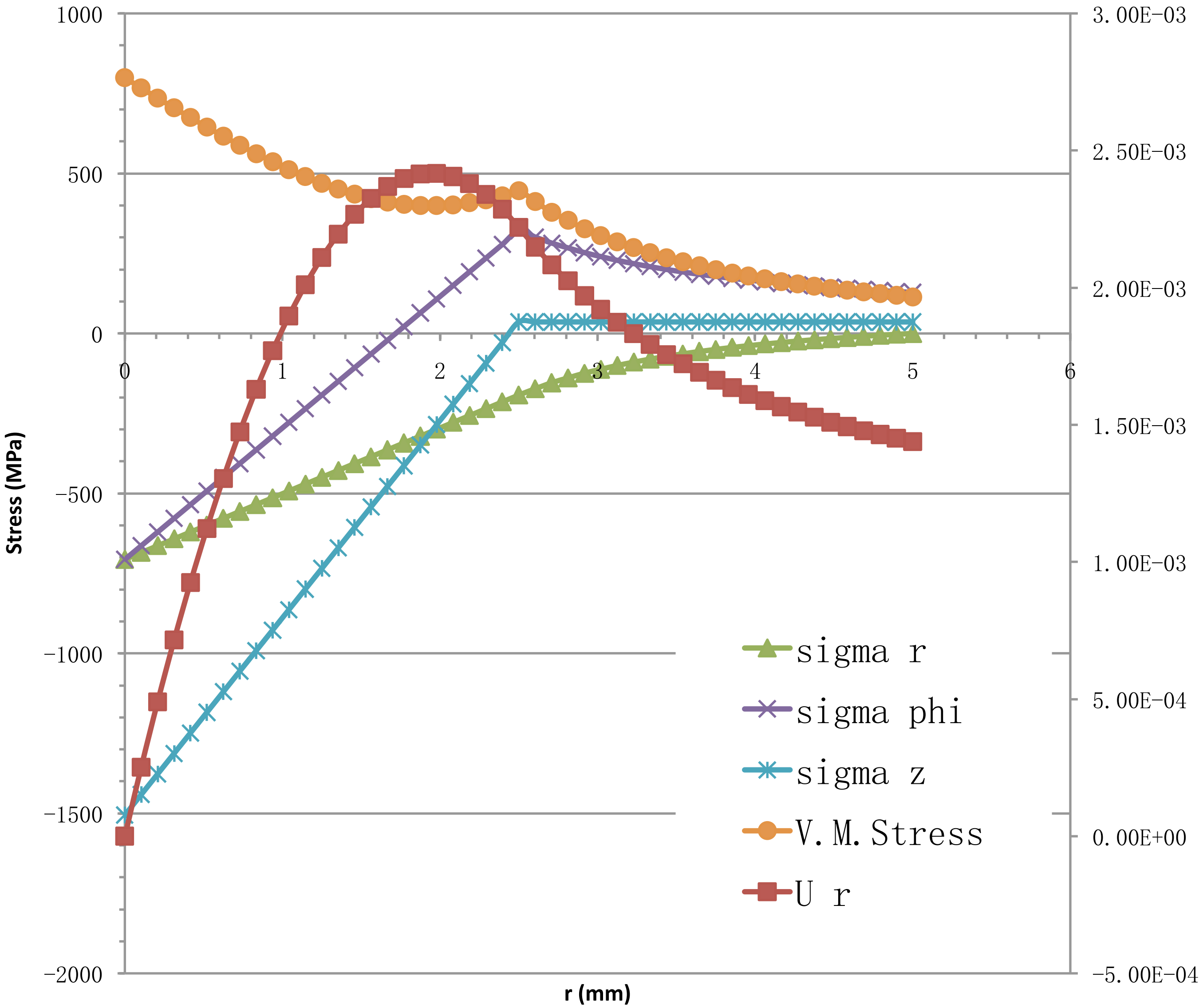




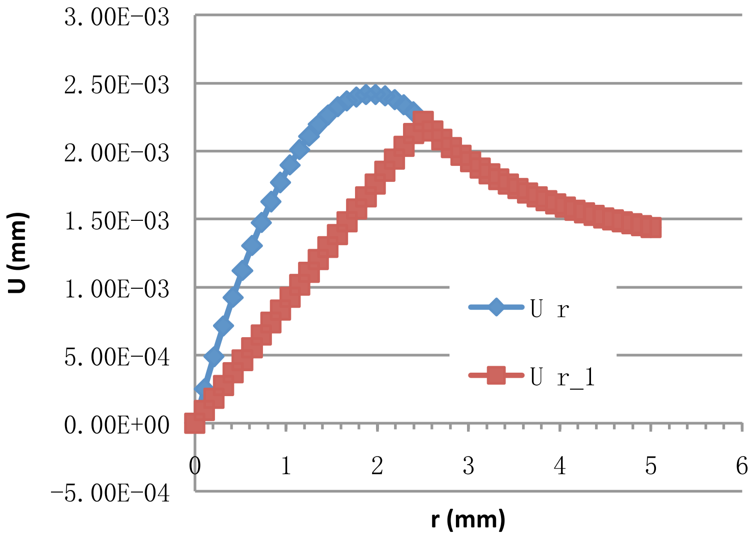
4) Give temperature a linear distribution, and axially constrained.

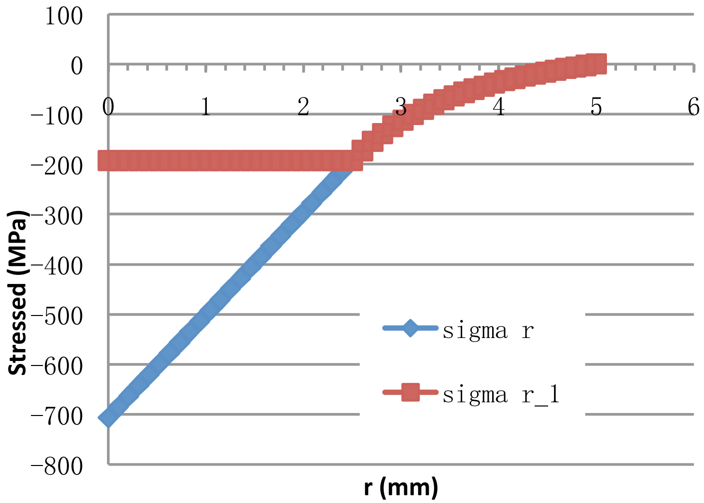


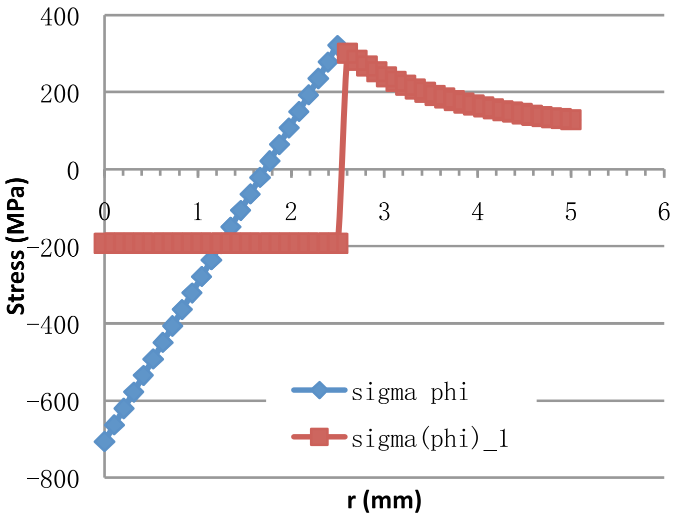


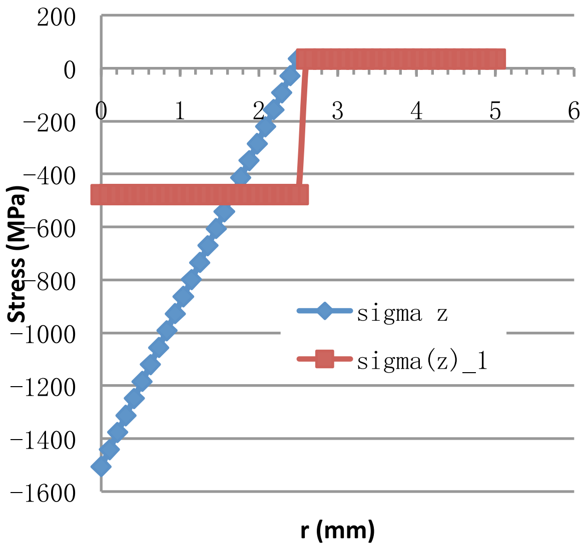


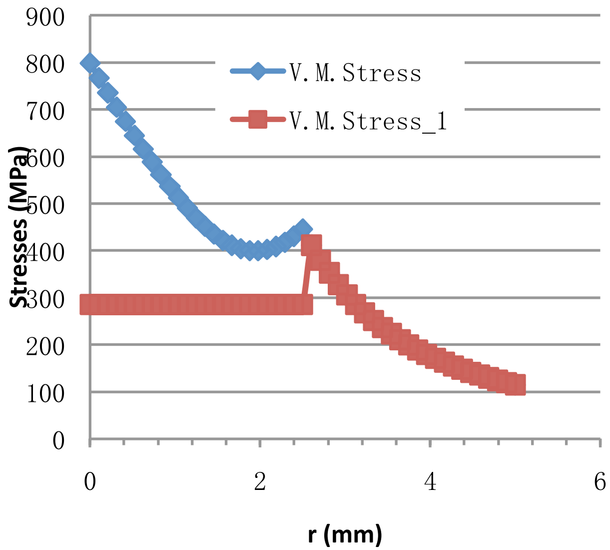
1000
500
0
-500
-1000
-1500
-2000
Stress (MPa)
0
1
2
3
4
5
6
r (mm)
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
-5.00E-04
sigma r
sigma phi
sigma z
V.M.Stress
U r


3. 00E-03
2. 50E-03
2. 00E-03
1. 50E-03
1. 00E-03
5. 00E-04
0. 00E+00
-5. 00E-04
U (mm)
0 1 2 3 4 5 6
r (mm)
U r
U r_1


100
0
-100
-200
-300
-400
-500
-600
-700
-800
Stressed (MPa)
0 1 2 3 4 5 6
r (mm)
sigma r
sigma r_1


400
200
0
-200
-400
-600
-800
Stress (MPa)
0 1 2 3 4 5 6
r (mm)
sigma phi
sigma(phi)_1


200
0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
Stress (MPa)
0 1 2 3 4 5 6
r (mm)
sigma z
sigma(z)_1


900
800
700
600
500
400
300
200
100
0
Stresses (MPa)
0 2 4 6
r (mm)
V. M. Stress
V. M. Stress_1

SUMMARY

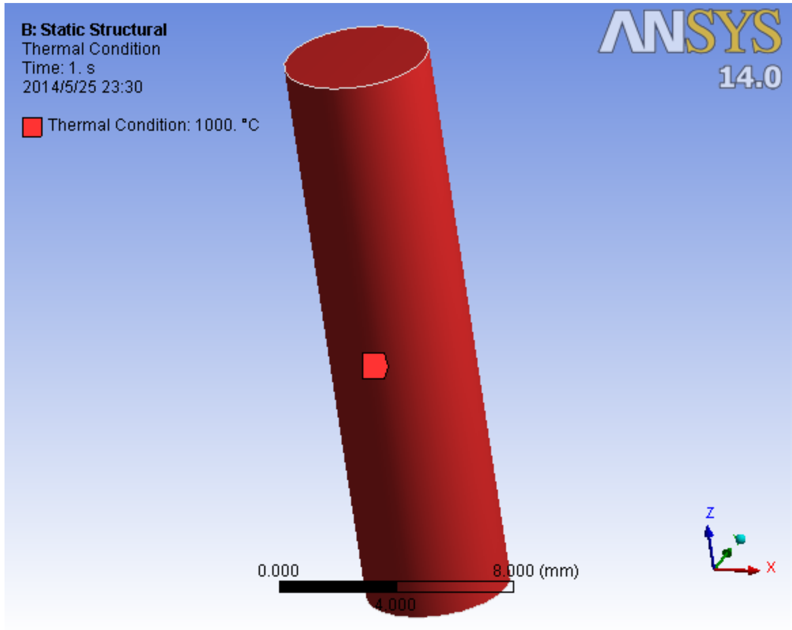
- For the cases that temperature is uniform for the inner part:
  - Stresses for the inner part are also uniform;
  - Stresses sigma r and sigma pi has the same value at inner part;
  - All the three stresses sigma r, sigma pi and sigma z has the negative value at inner part;
  - The largest displacement U(r) appears at the boundary between inner and outer part;
- Comparison of the two cases radially free and constrained, with the same uniform temperature for the inner part:
  - The variation tendency is the same for all the stresses;
  - But there are a uniform differences for each of the three stresses sigma r, phi and z for the two cases; but V. M. Stresses are the same for the outer parts in the two cases.
- For the case that has a different temperature distribution but same energy for the inner part, also both radially free:
  - The stresses are also not uniform at the inner part;
  - Stresses sigma r and sigma pi will not have the same value except at the first point;
  - But all the stresses are the same at the outer part for the two different cases;

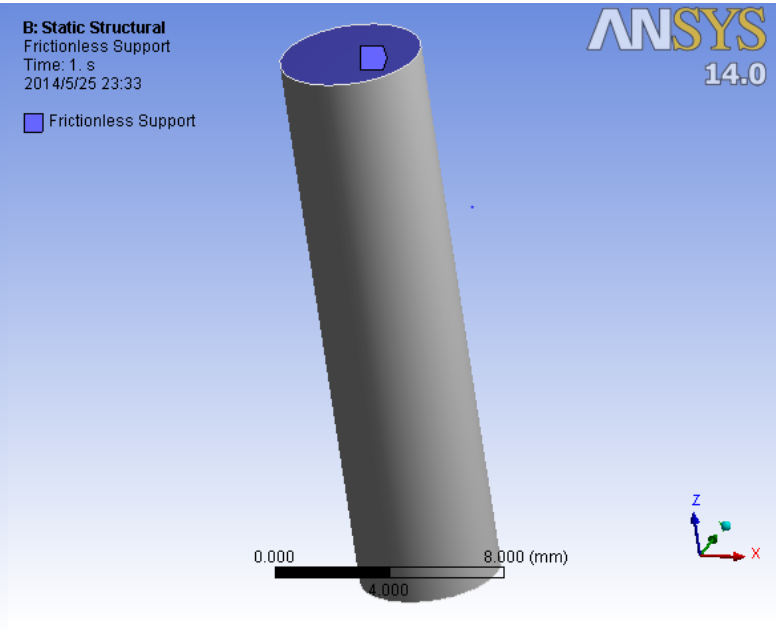
What I will do Next(1)

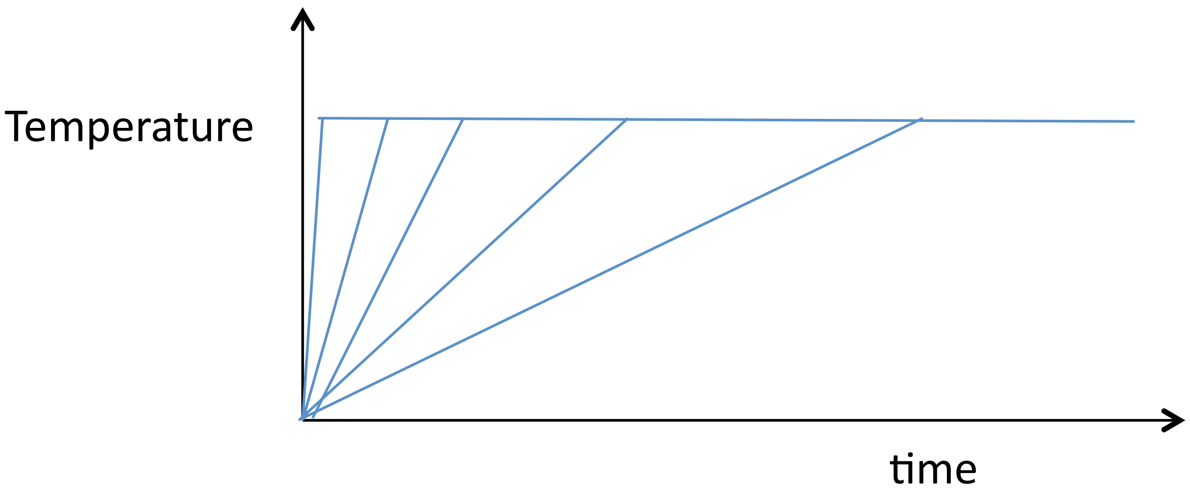
1) I will make some comparison where one of the individual stresses, tensile or compressive, is larger than the v. Mises;

2) And then to find whether there are any of the individual and v.M. is above the elastic or the fatigue limit, and if so, what will happen.

What I will do Next(2)







Thanks