Advanced Finite Elements

ME EN 7540 | **Cylinder with Temperature Dependent Conductivity** | **Spring 2006**

This example is taken from ANSYS verification manual example vm102. A long hollow cylinder is maintained at temperature T_i along its inner surface and T_o along its outer surface. The thermal conductivity of the cylinder material is known to vary with temperature according to the linear function $k(T) = C_0 + C_1 T$. Determine the temperature distribution in the cylinder:

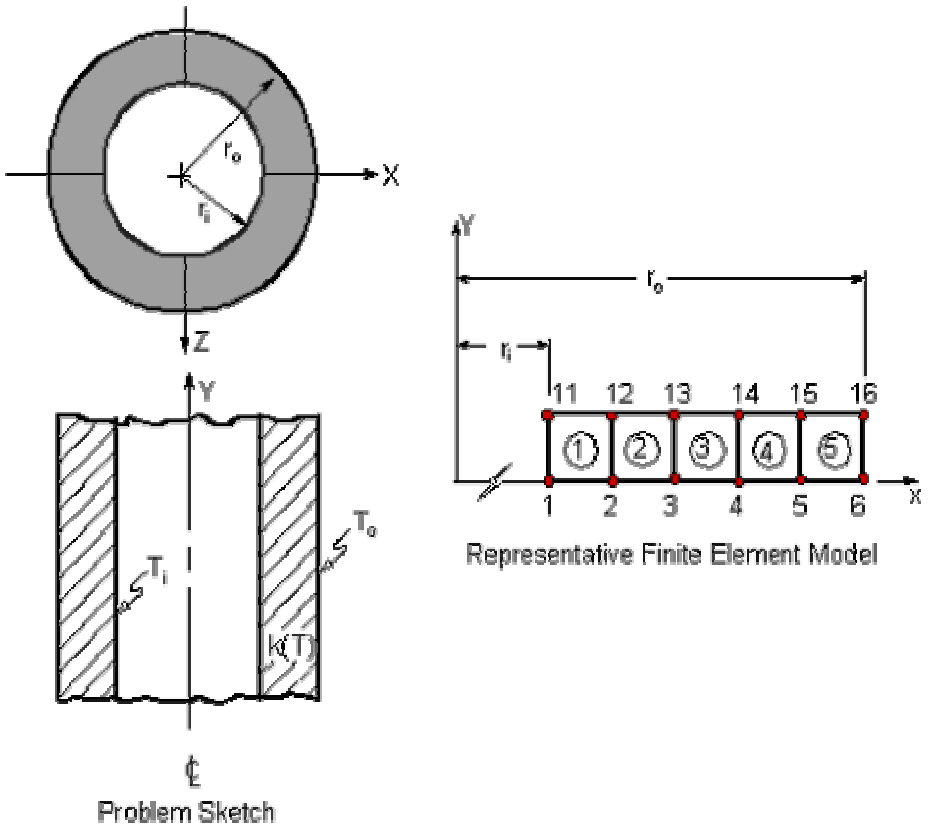

Figure 1 *Cylinder Problem Sketch.*

Material Properties	**Geometric Properties**	**Loading**
C_0 = 50 Btu/hr-ft-°F	r_i = 1/2 in = (1/24) ft	T_i = 100°F
C_1 = 0.5 Btu/hr-ft-°F^2	r_o = 1 in = (1/12) ft	T_o = 0°F

Analysis Assumptions and Modeling Notes

The axial length of the model is arbitrarily chosen to be 0.01 ft. Note that axial symmetry is automatically ensured by the adiabatic radial boundaries.

Results

Table 1 *Nodal temperatures.*

NODE	*T* (°F)
1	100.00
2	79.207
3	59.513
4	40.230
5	20.683
6	0.0000

Input Listing

```
/PREP7
/TITLE, CYLINDER WITH TEMPERATURE DEPENDENT CONDUCTIVITY
ANTYPE,STATIC

! AXISYMMETRIC OPTION
ET,1,PLANE55,,,1

! TEMPERATURE-DEPENDENT CONDUCTIVITY
MP,KXX,1,50,0.5

N,1,(1/24)
N,6,(1/12)
FILL
NGEN,2,10,1,6,1,,.01
E,1,2,12,11
EGEN,5,1,1
OUTPR,,1

! STEP BOUNDARY CONDITIONS
KBC,1
D,1,TEMP,100,,11,10
D,6,TEMP,,,16,10
FINISH

/SOLU
SOLVE
FINISH

/POST1
SET,1
NSEL,S,LOC,Y
PRNSOL,TEMP
FINI
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