

**Computer-Aided Project of Numerical Heat Transfer,
Xi'an Jiaotong University, 2016-12-14**

1. Project formulation

For air natural convection within an annular space as shown in Fig. 1 , following conditions are given: $\delta/r_o = 0.4$, flow is laminar and the average air temperature is 50°C .

For $\text{Ra} = g\beta\Delta T\delta^3\nu/a^2 = 10^2, 10^3, 10^4, 10^5$, determine the relative thermal conductivity: $\lambda_{\text{eq}}/\lambda_{\text{air}}$.The temperature difference between inner wall and outer wall is not large, so the Boussinesq assumption can be adopted. By using Tecplot or other software, display the isotherms and streamlines and the variation of $\lambda_{\text{eq}}/\lambda_{\text{air}}$ vs. Ra.

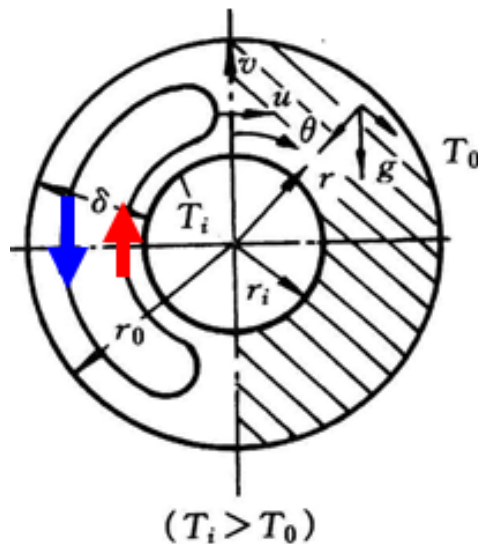


Figure 1 Natural convection in annular space

2. Suggestions and Requirements

- 1) Considering the symmetry of the geometry, only half of the structure should be simulated.
- 2) The solution should be grid-independent.
- 3) The project report should be written in the format of the Journal of Xi'an Jiaotong University. Both Chinese and English can be accepted.
- 4) It is encouraged to use the teaching code, yet commercial software may also be used.
- 5) When the teaching code is adopted, please submit in the USER part developed by yourself for solving the problem.
- 6) The project report should be due in before April 30, 2017 to room 204 of East 3rd Building.

References

- [1] Kuhen T H, Goldstein R J. An experimental and theoretical study of natural convection in the annulus between horizontal concentric cylinders. J Fluid Mechanics, 1976, 74:605-719