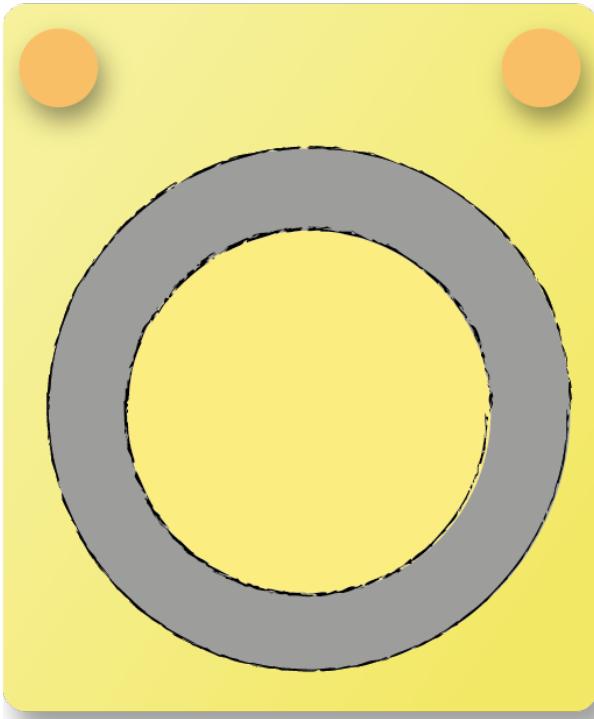


Lecture 5 - Question 3



Can the curvature of a pipes wall and thus the change of area be neglected and if so under which conditions?

In case of a thin pipe and large radii the relative change of cross section area is small and can thus be neglected. That is a thin pipe can be treated as a plane wall. A more formal derivation of the simplification can be obtained by investigating the expression for heat flux or temperature profile in a pipe:

$$\dot{Q} = 2\pi\lambda L \frac{T_1 - T_2}{\ln \frac{r_2}{r_1}}$$



For values close to unity the logarithm can be simplified as

$$\ln x \approx x - 1$$

and such

$$\ln \frac{r_2}{r_1} \approx \frac{\delta}{r}$$

This yields the corresponding equation for a wall of area $2\pi Lr$ and thickness δ .