Task 5.4

a) 1200 m^3 water per hour

$\Rightarrow \dot{V} = 1200 \frac{m^3}{h} = \frac{1200 \, m^3}{3600 \, s} = \frac{1}{3} \frac{m^3}{s}$

pipe diameter $d = 0.5 \, m$

$\Rightarrow$ pipe cross section $A = \pi \left(\frac{d}{2}\right)^2 = \ldots\ldots \; m^2$

$\dot{V} = \bar{u} A \Rightarrow \bar{u} = \frac{\dot{V}}{A} = 1,7 \ldots \frac{m}{s}$ average velocity

$\Rightarrow Re = \frac{\rho \bar{u} d}{\mu} = \frac{\bar{u} d}{\nu}$ $\quad \nu = \frac{\mu}{\rho}$

μ dynamic viscosity, ν kinematic viscosity

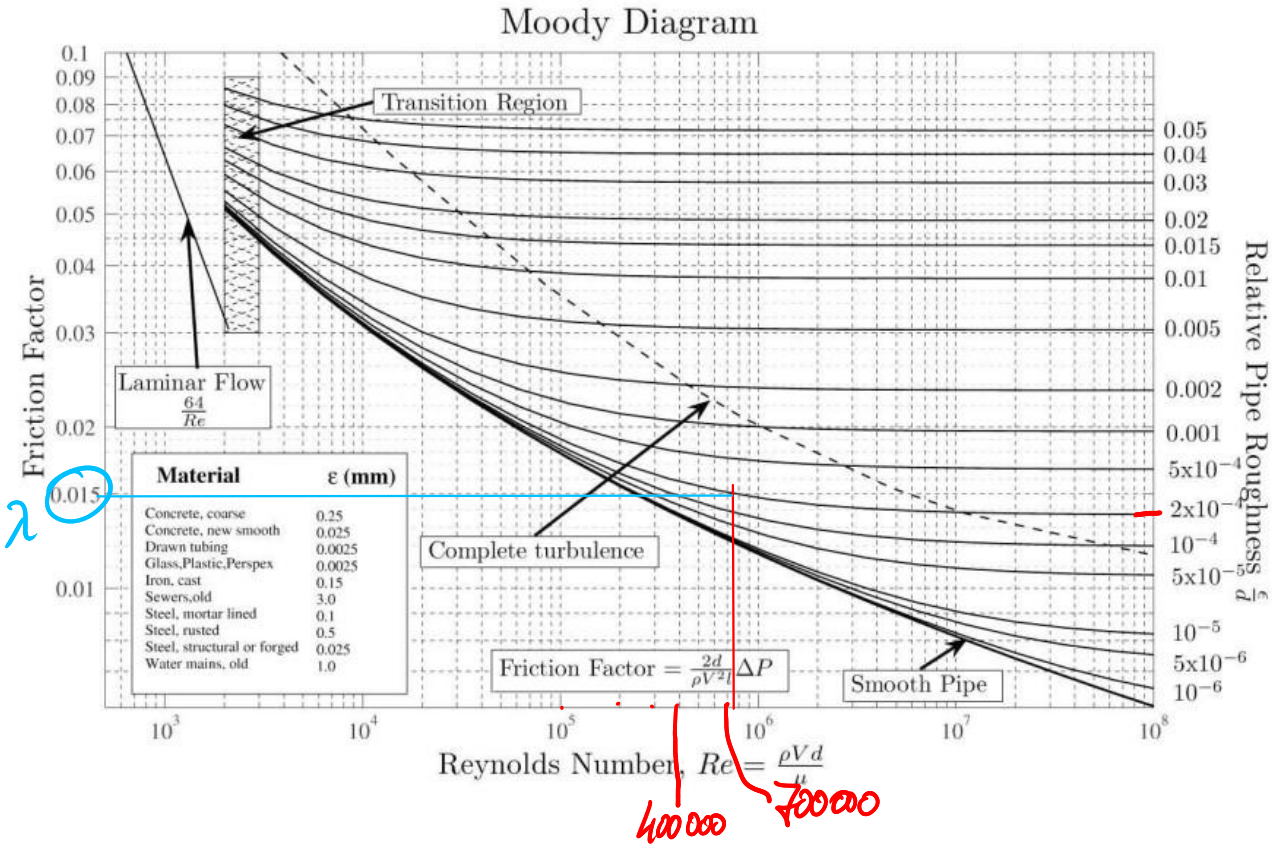
$= 752212 \Rightarrow$ turbulent $\Rightarrow$ Moody

b) Need relative roughness $k = \frac{\varepsilon}{d} = \frac{0,1 \, mm}{0,5 \, m} = \frac{0,1 \cdot 10^{-3}}{0,5}$

$= \frac{1}{5} \cdot 10^{-3} = 0,0002$

$\Rightarrow$ nächste Seite / next page

Task 5.4 (cont'd)



$$\Delta p = \frac{L}{d} \lambda \frac{\rho}{2} \bar{u}^2 = \frac{2000\,m}{0{,}5\,m}\ 0{,}015\ \frac{1000}{2}\ \frac{kg}{m^3}\ 1{,}7^2\ \frac{m^2}{s^2}$$

$$= 4000 \cdot 0{,}015 \cdot 500 \cdot 1{,}7^2\ \frac{kg}{m^2} \cdot \frac{m}{s^2}$$

$$= 86700 \qquad \left(kg\,\frac{m}{s^2}\right)/m^2 = Pa$$

(gerundetes $\bar{u}$, sonst 86961 Pa)

Task 5.2

how to go about lengthe formulae?

eg.

$$\Delta t = \underbrace{\frac{8\pi\mu l_2 l_1}{F}}_{T_1} \underbrace{\frac{r_1^4}{r_2^4}}_{T_2}$$

$$T_1 = \frac{8\pi\mu l_2 l_1}{F} = 1{,}2 \cdot 10^{-5}$$

$$T_2 = \frac{r_1^4}{r_2^4} = 390625$$

$$\left.\begin{aligned} r_1 &= 5 \cdot 10^{-3} \\ r_2 &= 2 \cdot 10^{-4} \end{aligned}\right\} \Rightarrow \frac{r_1}{r_2} = \frac{5}{2} \cdot 10 = 25$$

$25^4 =$ something "big"

$$\Delta t = T_1 * T_2 = 4{,}715$$