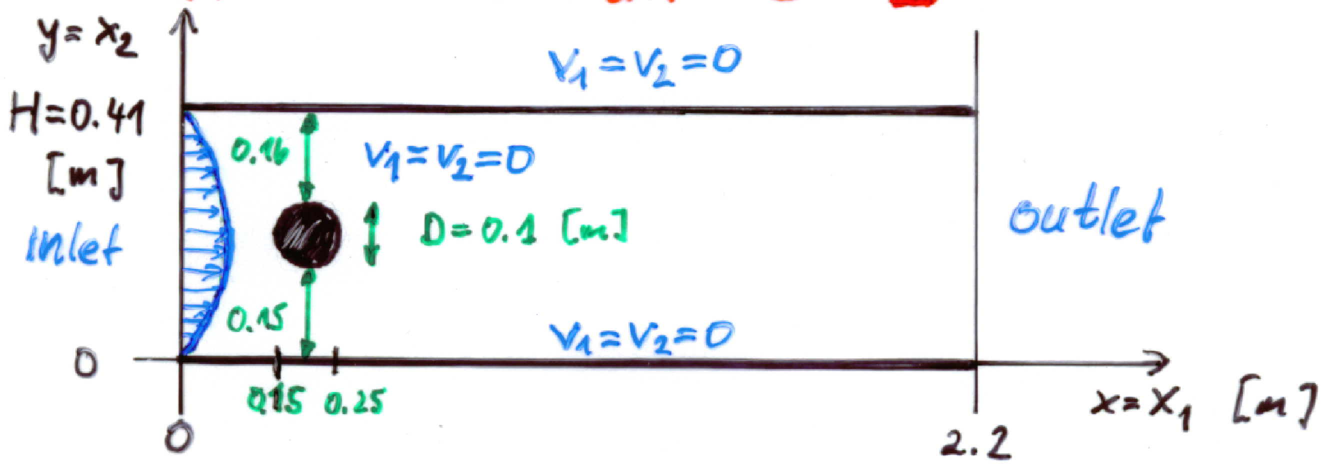
4. Benchmark: Strömung um Zylinder

$\nu = 10^{-3}\ [\frac{m^2}{s}]$ (Kinematische Viskosität)

$\rho = 1{,}0\ [\frac{kg}{m^3}]$ (Dichte)

4.1. Der 2D Fall:



<u>Stationär:</u> $v_1(0,y) = 4 v_m y (H-y) / H^2$, $v_2(0,y) = 0$

mit $v_M = 0.3\ [\frac{m}{s}]$

$\Rightarrow Re = \bar{U} D / \nu = 20$ mit $\bar{U} = \frac{2}{3} v_1(0, \frac{H}{2})$

<u>Instationär:</u> $v_1(0,y,t) = 4 v_m y (H-y) \sin(\pi t/8) / H^2$

$v_2(0,y,t) = 0$

$t \in [t_A, t_E] = [0, 8]$ [s]

AB: $v_i(x,y,0) = 0$, $i = 1,2$

$\Rightarrow Re = \bar{U}(t) D / \nu \in [0, 10]$ mit $\bar{U}(t) = \frac{2}{3} v_1(0, \frac{H}{2}, t)$

<u>Ges:</u> Drag force F_D und Lift force F_L : $S =$ (Zylinderrand, Normale n)

$F_D = \int_S (\rho \nu \frac{\partial v_t}{\partial n} n_2 - p n_1)\, dS$, $F_L = -\int_S (\rho \nu \frac{\partial v_t}{\partial n} n_1 - p n_2)\, dS$

wobei $n = (n_1, n_2)$, $t = (n_2, -n_1)$, v_t – Tangentialgeschw.

Drag coefficient c_D und Lift coefficient c_L:

$c_D = 2 F_D / \rho \bar{U}^2 D$, $c_L = 2 F_L / \rho \bar{U}^2 D$