Tutorial 6 (Week 13, 30.6.2020) Microfluidics

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Capillarity

Find the expression for the Young–Laplace pressure drop across a liquid/gas interface with surface tension coefficient γ inside a flat and very wide rectangular channel of height h, where the contact angle for the bottom and top plate are given by θ_1 and θ_2, respectively.

Two-Phase Flow

1. Derive the expressions for h_1 and h_2 for the two-phase Poiseuille flow in Chapter Two-Phase Flows (Two Phase Flows.ipynb). Discuss the limits of $\mu_1 \to 0$ and $\mu_2 \to \infty$ if they make sense.
2. The dispersion relation $\omega(k)$ for gravity waves is given by Eq. (20) in Chapter Two-Phase Flows](Two Phase Flows.ipynb). Discuss the physical interpretation of this expression for $\rho_1 > \rho_2$ and for $\rho_1 < \rho_2$. Does the finding relate with your experiences, if yes give examles. Hint: consider the time evolution using the complex notation $e^{-i\omega t}$ for the time dependence.

Electrosmotic Flow

Plot the electric potential and the flow profile for the electric osmotic flow in a infinitely long flow channel as a function of z. Start with the program in Chapter Electrosomotic flow (Electrosomotic flow.ipynb). Derive from Eq. (27) in Chapter Electrosomotic flow (Electrosomotic flow.ipynb) the flow rate Q through the thin channel.