SESSION 7: SYSTEMS BASED ON MICROELECTRODES FOR LAB-ON-CHIP APPLICATIONS

Exercise 1.

Microelectrodes for impedance sensing:

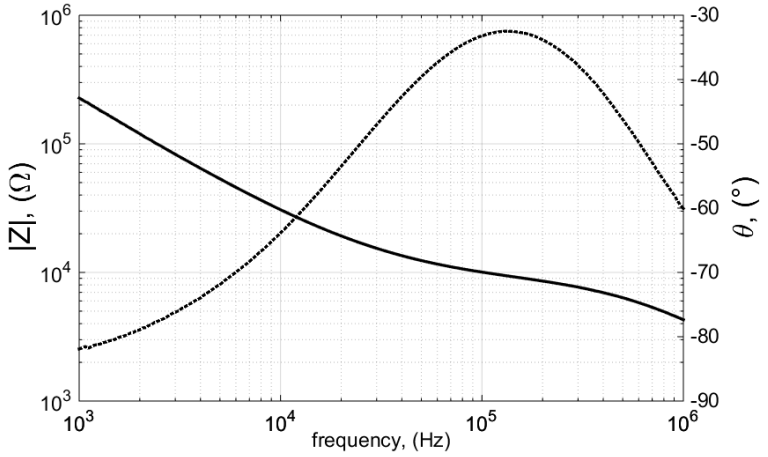
Two parallel Pt electrodes sizing 30x30 μm^2 and spaced 30 μm in a microfluidic channel on a silicon substrate. The microchannel is filled with PBS1X (conductivity ~ 1.57×10^{-2} S/cm @ Room T°).

1.a Represent the electrical equivalent circuit in 1 kHz-10 MHz range of frequency in the hypothesis of absence of faradaic processes.

1.b Estimate the value of the resistance of the solution (R_{SOL}).

1.c Estimate the value of the double layer capacitance at the electrode/electrolyte interface (C_{DL}) (typical value of the capacitance per unit surface: 20 $\mu F/cm^2$).

1.d Given the Bode plots in figure (Fig.1), evaluate the current at around 100 kHz when a 50 mV sinusoidal amplitude stimulus is applied.



(Fig.1)

Exercise 2.

Microelectrodes for cell stimulation:

Consider to stimulate neurons cultured in a microfluidic channel where a pair of facing electrodes are patterned on the sidewall of the channel (h = 50 μm, L = 300 μm, d = 500 μm). A square voltage of amplitude 1 V, mean value 0 V and period 1s is applied. What is the value of the potential applied to the solution at t = 200 ms?

(Consider: C_{DL} = 1 nF, R_{sol} = 10 KΩ placed in series)