Design of the ISS-Bioreactor

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(Dated: April 5, 2023)

This is a technical report for ISS-Bioreactor project at Boise State University.

1. INTRODUCTION

2. APPARATUS AND EXPERIMENT

The current i over the capacitor is $i = C\frac{\mathrm{d}v_c}{\mathrm{d}t}$. Therefore, KVL around the circuit gives

$$RC\frac{\mathrm{d}v_c}{\mathrm{d}t} + v_c = v_{\text{sig}} = A\cos(\omega t) \tag{1}$$

This differential equation has the transfer function

$$G(s) = \frac{1}{RCs+1}.$$

The steady-state solution of the differential equation (1) is obtained as

$$\begin{aligned} v_c(t) &= A\,|G(j\omega)|\cos(\omega t + \angle G(j\omega)) \\ &= \frac{A}{\sqrt{1+\omega^2R^2C^2}}\cos(\omega t - \arctan(\omega RC)) \end{aligned} \tag{2}$$

Since we do not want our signal to be attenuated by the low-pass filter, we must choose the values of R and C such that $\omega RC \ll 1$ or $RC \ll 1/\omega$. A difference of at least an order of magnitude should do nicely.

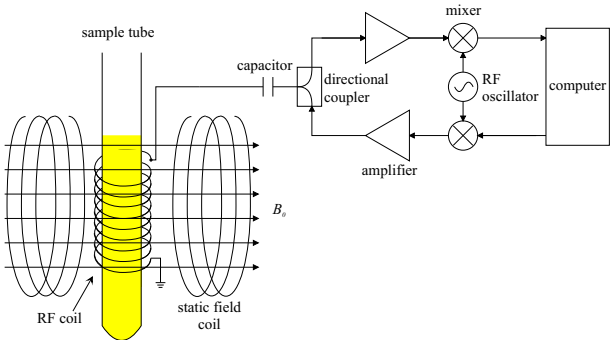

FIG. 1: This is a placeholder figure until I draw the RC network.

3. ANALYSIS AND RESULTS

4. DISCUSSION AND CONCLUSIONS