Laboratory Project 1b: Electromyogram Circuit

Report Contents and Grading

30 Communication
   – IEEE single column, double spaced format, title, author, etc. (–20 pts if not used)
   5 Style (written in the style of article, rather than disjointed figures and tables)
   5 English (grammar, punctuation, and etc.)
   5 Clarity (purpose of each section clearly explained)
   3 Succinctness and precise wording (detailed information in as few words as possible)
   3 Organization (ease of locating figures/code/equations/etc.)
   3 Section numbers and headings (use section numbers shown below)
   3 Equations explained (at least one sentence between equations)

5 Abstract (succinct summary of results, including numerical values as appropriate)

10 I. INTRODUCTION
   8 Motivation/background for lab [create EMG circuit, useful for medical diagnostics]
   2 State report organization [briefly describe contents of sections that follow]

10 II. PRE-AMP DESIGN, TEST, AND CONSTRUCTION (Lab 1b Section IV and V)
   A. Electrode model and pre-amp model
      1 Introduce section [to demonstrate need for pre-amp to drive diff-amp]
      1 Explain model of electrode [small v-source in series with 1 MΩ]
      1 Describe why electrode driving diff-amp gives signal out ≈ 0 V [include Fig. 4a]
      1 Comment on test results from your Table II [data not required]
   B. Pre-amp model
      1 Explain model of pre-amp [small v-source in series with 10 Ω]
      1 Describe why pre-amp driving diff-amp gives signal out ≈ input [include Fig. 5a]
      1 Comment on test results from your Table III [data not required]
      1 Comment that pre-amp
   C. Pre-amp circuit
      1 Describe pre-amp circuit you built [include Fig. 6b, crop out LED's]
      1 Describe results of pre-amp tests in words

25 IV. DIFFERENTIAL AMPLIFIER DESIGN AND TEST (Lab 1b Section VI, VII.A,B)
   A. Analysis of differential amplifier
      2 Describe differential amplifier circuit [Lab 1b Fig. 8]
      3 Give the formula for \( v_3 \) versus \( v_1 \) for \( v_2 \)
      3 Give the formula for \( v_3 \) written in terms of \( v_{cm} \) and \( v_{dm} \)
      2 Give the formula for \( v_3 \) written in terms of \( \Re = R_1/R_2 = R_3/R_4 \)
      1 Explain that \( v_3 \) written in terms of \( \Re \) is only a function of \( v_{dm} \)
      2 Explain why having \( v_3 \) be only a function of \( v_{dm} \) is desirable
   B. Design of differential amplifier
      3 Explain how resistor values were chosen
      4 List values of resistors used in diff-amp
   C. Testing of differential amplifier
      2 Describe testing procedure [include Lab 1b Fig. 11]
      3 Explain calculation of gain of diff-amp [= slope of plot] and list value of gain

15 V. EMG MEASUREMENT (Lab 1b Section VIII)
   A. Measurement of EMG
      1 Explain how electrodes and oscilloscope connected for EMG
      5 Show plot of EMG from oscilloscope [use Matlab® to make plot]
   B. Power vs weight for EMG signal
      2 Explain how power for EMG calculated [Lab 1b Eqn (6)]
      5 Show plot of power vs weight
      2 Comment on plot [describe shape, possible measurement errors]

5 CONCLUSION (summarize key results; include numerical values as appropriate)