Introduction to Sensors, Measurement and Instrumentation

Lab 5: Using filters to build an electrocardiograph (ECG or EKG)

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March 4, 2023

Bode Plot

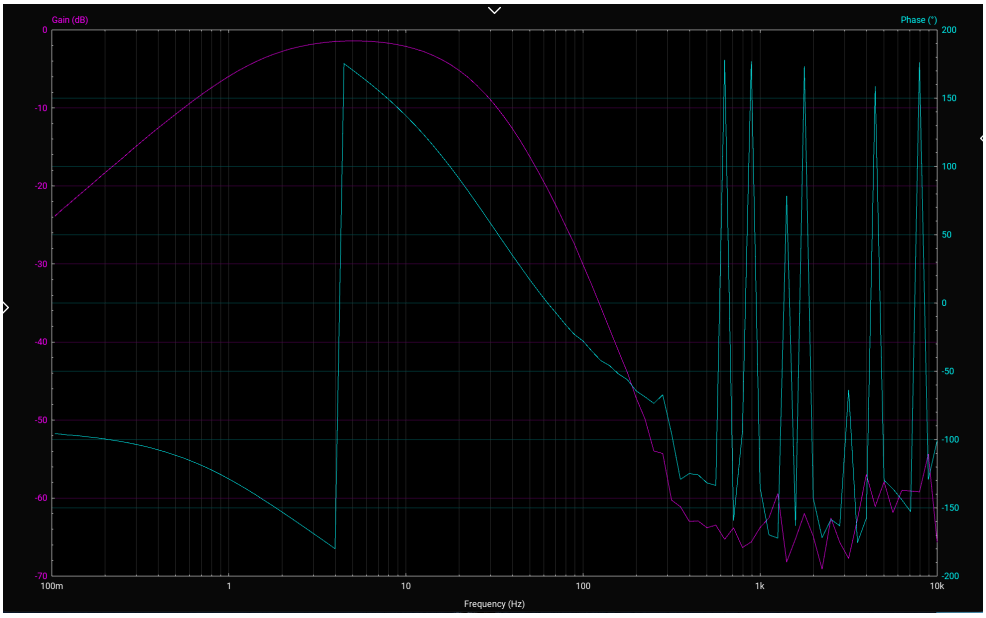

Figure 1: The Bode plot (Gain(dB) vs Frequency (Hz)) for the EKG Waveform-generator circuit is made for measuring the Amplitude.

EKG

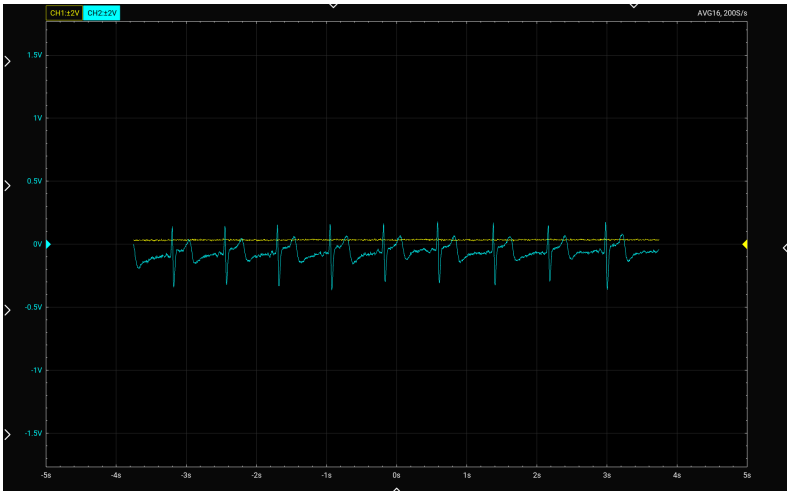

Figure 2: The EKG trace obtained from collecting the heartbeat data by placing the electrodes on a human wrist.

Circuit Photo

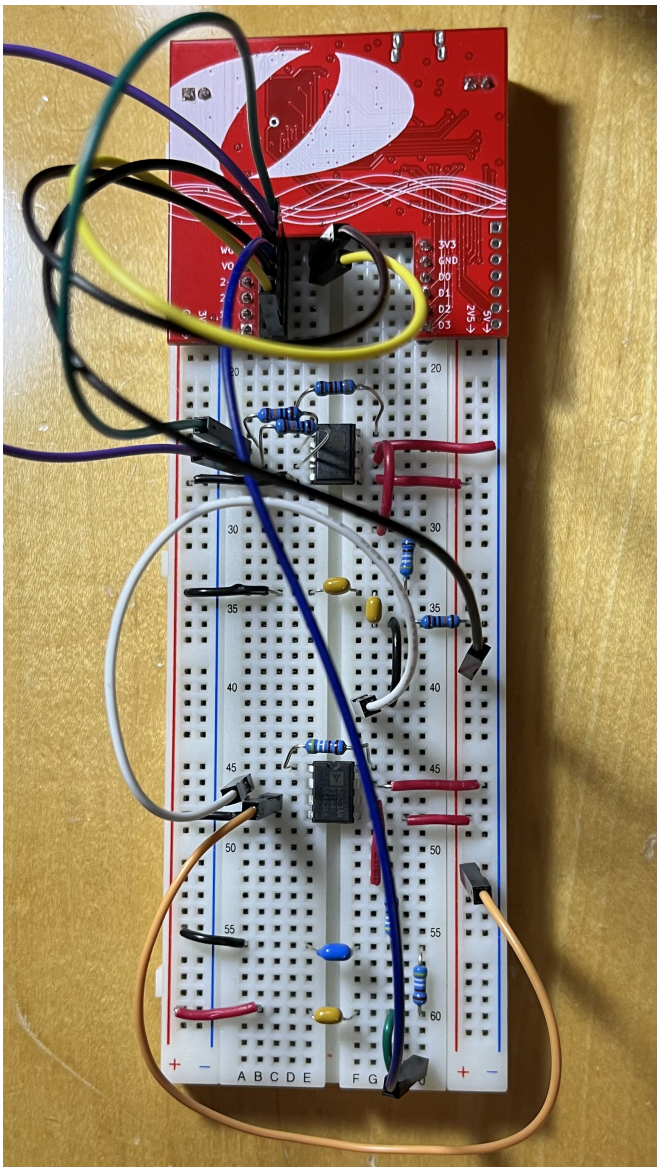

Figure 3: The O-scope EKG circuit photo

Circuit Description

The circuit utilizes two stages consisting of filters that amplify the voltage signal using the AD623 chip.

The first stage consists of a passive band-pass filter which filters out both high and low frequencies. The second stage has two RC circuits in series which make up two lop=pass filters.

The characteristic frequencies of this circuit are approximately 1 Hz on the lower end and 20 Hz on the higher end.

The AD623 is an integrated, single- or dual-supply instrumentation amplifier and has a wide input common-mode range and amplifies signals with common-mode voltages as low as 150 mV below ground. Therefore, using the AD623, the gain in the first stage is equal to 51, and the gain in the second stage is equal to 21. Therefore, the output voltage when these two stages act together in a circuit gets amplified by a factor of approximately 1000.