ULTRASONIC BLOOD FLOW SENSING USING DOPPLER VELOCIMETRY

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Abstract- Ultrasonic blood flow sensing is a non-invasive method for measuring blood flow velocity. The objective of this work is to produce a low-cost ultrasonic blood flow instrument utilizing Doppler shifted signals and enhanced signal processing methods. The instrument transmits a single-frequency signal into circulatory tissues and receives a signal that is Doppler shifted in proportion to velocity. Subsequent processing techniques produce an audio feedback signal whereby the user "hears" the flow characteristics. The circuit used consists of a transmitter, receiver, and frequency shifter. Signal processing is performed externally to produce velocity profiles of arterial blood flow using Matlab™ to create spectrograms and low-pass filtering on the recorded feedback signals. Spectrogram provide mapping of the velocity profiles. Resultant mapping indicate that velocity profiles have a roughly parabolic shape and that filtering is required to reduce high frequency noise. Signals were obtained using multiple cardiac stressors to determine the flow sensing performance.

Index terms*:* cardiac sensing, digital filters, Doppler Effect, Matlab™, signal processing, spectrogram, ultrasonic flow meter, velocimetry, velocity profiles.