

M. Ingle and P. C. Pandey, Cardiac output monitoring with an impedance cardiograph, Proc. First Regional Conf. IEEE/EMBS 1995, New Delhi, India

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***Abstract*** - Information about the pulse rate and stroke volume can be obtained by monitoring changes in the impedance of the thoracic region due to flow of blood. Here an instrument which monitors the thoracic impedance using ECG chest electrodes has been used. In the instrument developed earlier a high frequency (100 kHz), low intensity sinusoidal current is injected into the thoracic region and the voltage waveform obtained by modulation of the current waveform because of thoracic impedance is sensed. The waveform is then amplified and demodulated to get the impedance waveform  $Z(t)$ . Waveform  $Z(t)$ , its derivative  $dZ/dt$ , and derivative of the ECG waveform  $de/dt$  are fed through signal isolators (opto couplers) to an ADC card installed in a PC. The impedance derivative ( $dZ/dt$ ) is averaged using  $de/dt$  waveform as a trigger, and then is used for calculating the stroke volume. Heart rate is found from the  $de/dt$  waveform. The product of stroke volume and the heart rate gives the cardiac output.

Experiments were carried out using this instrument for monitoring Cardiac output. Readings were taken with several subjects in resting position as well as while doing exercise using exercise bicycle. The results showed relationship of the heart rate and cardiac output.