

Manaskant D. Desai, Development of an impedance cardiograph, M. Tech. Thesis, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, June 2012.

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Abstract: Impedance cardiography is a non-invasive technique for estimating the stroke volume and cardiac output by measuring the variations in the thoracic impedance. The project objective is to design impedance cardiograph hardware by exploring the use of new circuits and modifications in earlier design for improved performance. A direct digital synthesizer (DDS) is used for highly stable sinusoidal source with digital control of frequency. An operational trans-conductance amplifier (OTA) is used in the design of voltage-to-current converter. A synchronous demodulation scheme is implemented with current steering and analog switches in order to improve carrier ripple rejection and eliminate the error due to the slew rate of the op-amp. Another DDS is used to provide the reference clock with programmable phase shift for synchronous demodulation. The demodulator circuit incorporates digitally controlled baseline correction. Two digital potentiometers are used to control the current amplitude and baseline correction independently. A microcontroller is used for parameter setting, control of circuit blocks, signal acquisition, and preliminary processing. The sensed impedance signal is differentiated digitally and analog output is generated. A serial flash is provided for storing the acquired signals. An isolated RS232 interface with the PC is provided to set the parameters from the user interface on the PC and for data transfer. The circuit is battery powered and can also be powered from USB connector.