Neelima Mandloi, Development of an impedance glottograph, M. Tech. Thesis, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, June 2011.

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***Abstract:*** The impedance glottography or electroglottography (EGG) is a noninvasive method to monitor the functioning of the vocal folds, by measuring the time varying electrical impedance across a pair of electrodes placed in contact with the skin on both sides of the thyroid cartilage. The project objective is to develop (a) a microcontroller based laryngeal impedance simulator for testing sensitivity and frequency response of the impedance glottography hardware and (b) a glottal impedance detector using a synchronous amplitude demodulation for improving the noise and ripple rejection and for improving the frequency response.

A circuit for simulating laryngeal impedance, using a digital potentiometer and a microcontroller has been developed, tested, and prototyped. Simulator parameters (frequency, basal resistance, and change in basal resistance) are set through four keys and 2 line X 16 character LCD.

The impedance glottography hardware involves the sinusoidal source, the voltage-to-current converter, and the demodulator for sensing the small variation in the laryngeal impedance. A direct digital synthesizer (DDS) chip is used to get sinusoidal waveform with high amplitude stability and selectable frequency. The trans-conductance operational amplifier (OTA) in complementary current configuration is used for the voltage-to-current conversion. Synchronous demodulation uses current steering by analog multiplexers for high noise rejection, automatic baseline restoration for high sensitivity, and low-pass filtering and synchronous sampling for high carrier rejection and very low phase distortion. Another DDS chip is used to generate synchronized square wave with settable delay to serve as the reference input for controlling the switches for synchronous demodulation. Excitation current for the measurement of the impedance and the baseline restoration are controlled using two digital potentiometers. All the operations are controlled by a microcontroller with an isolated serial interface. The assembled circuit along with the software needs to be thoroughly tested and calibrated.