

Priyanko Mitra, Enhancement of electrolaryngeal speech by background noise reduction and spectral compensation, M. Tech. Thesis, Department of Electrical Engineering, Indian Institute of Technology Bombay, 2006.

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Abstract - Transcervical electrolarynx is a vibrator held against the neck tissue by a laryngectomy patient to provide excitation to the vocal tract, as a substitute to that provided by glottal vibrations. Major problems with electrolaryngeal speech are lack of voicing and pitch control, deficiency of low frequency content, and background noise from the vibrator and vibrator-tissue interface. Pitch synchronous application of spectral subtraction has been earlier used for reducing the self leakage noise, with averaging based noise estimation (ABNE) on an initial segment with closed lips. As the leakage noise spectrum varies with speech production, and vibrator orientation and pressure, quantile based noise estimation (QBNE) has been used for dynamically estimating the noise spectrum, but had residual noise in the silence regions. A real time implementation has been earlier done without phase reconstruction or spectral compensation. In this project, a real time system has been devised for background noise reduction along with low frequency compensation. Effective noise reduction comparable to that in offline processing is obtained in the real time implementation of ABNE using Analog Devices 16-bit fixed point Blackfin processor ADSP BF 533. A dynamic minimum statistics based noise estimation (MSBNE), with two-pitch period analysis frames and one period overlap is investigated. Minimum value of each spectral sample in a set of past frames is used for dynamically estimating the noise magnitude spectrum. Smoothing of the estimated noise spectrum resulted in better noise reduction. Compared to QBNE, the MS based method gives less residual noise, takes much lower processing time, and requires a lower number of windows for optimum noise updating. Real time implementation of MSBNE showed reasonable noise reduction, comparable to that in offline processing.