

Nitya Tiwari, Implementation of Multi-band Frequency Compression for Listeners with Moderate Sensorineural Impairment, M. Tech. Thesis, Department of Electrical Engineering, Indian Institute of Technology Bombay, June 2012.

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Abstract: Widening of auditory filters in persons with sensorineural hearing impairment leads to increased spectral masking and degraded speech perception. Multi-band frequency compression of the complex spectral samples using pitch-synchronous processing has been reported to increase speech perception by persons with moderate sensorineural loss. It is shown that implementation of multi-band frequency compression using fixed-frame processing along with least-squares error based signal estimation reduces the processing delay and the speech output is indistinguishable from pitch-synchronous processing.

For real-time operation, the processing is implemented on a DSP board based on the 16-bit fixed point processor TMS320C5515. Codec and DMA are used to continuously acquire the input signal and output the processed signal at a sampling rate of 10 kHz. The data transfer and buffering operations are devised for an efficient realization of analysis-synthesis with 75 % overlap. The spectral modification operations are facilitated by the on-chip FFT hardware. The real-time processing with analysis window length of 26 ms and 512-point FFT is implemented, using about one-tenth of the computing capacity of the processor. The processing delay is approximately 35 ms, making it suitable for hearing aid applications.