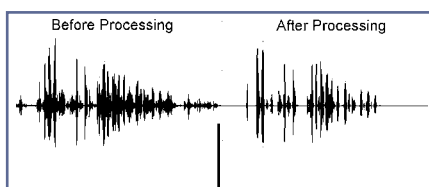


ClearSpeech technologies -
a suite of signal processing
algorithms, hardware and
technical expertise for enhancing
voice communications.



**Background echo removed
from near end send signal**

Operation

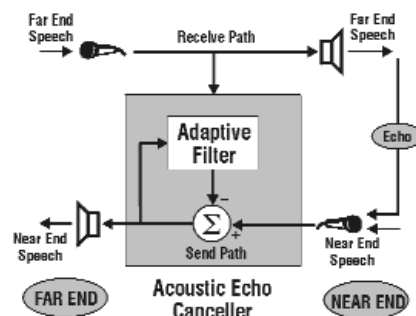
ClearSpeech® Acoustic Echo Cancellation (AEC) is an algorithm designed to continuously and adaptively remove acoustic echo from speech.

Acoustic echoes are produced by the open-air acoustic path between the loudspeaker and the microphone in hands-free full-duplex communication systems. By continuously tracking changes in this acoustic path, AEC effectively eliminates the echo, improving the clarity of the communication system.

AEC is effective against the acoustic echo experienced in such systems as hands-free cellular telephony, Internet telephony and audio and video conferencing.

Block Diagram

As illustrated below, an echo canceller can remove acoustic echo produced by the open-air acoustic path between the loudspeaker and the microphone in a hands-free, full-duplex communication system.



Performance Characteristics

- Convergence time < 1 second
- ERLE > 50dB
- ERLE @ 1 sec >50dB
- No attenuation
- ITU-T G.167 compliant

Implementation

AEC is an adaptive, frequency-domain block LMS algorithm designed as a re-entrant module.

Available versions:

- 64ms or 128ms echo span, 64-sample block length, 8kHz sampling rate
- Optional comfort noise
- Optional telephony bandpass filter

Details of the platforms supported can be found on our website.

Software Requirements

For 8 kHz sampling rate, 64-sample block length, 64 msec echo span version. Comfort noise and bandpass filter selected:

V 2.1	Fixed-Point	Fixed Point
DSP	ADSP-2181	TMS320-C5416
MIPS	10.7	19.2
Program Memory (words)	4.4k (24 bit words)	4.1k (16 bit words)
Data Memory (words)	4.1k (16 bit words)	5.7k (16 bit words)
Algorithmic Delay (msec)	<20	<20



Demonstration Platforms Available

- For customers wishing to process their own wavefiles on a Windows®-based demonstration program please contact us.
- To facilitate evaluation of AEC for real-time applications, a standard hardware platform, the Algorithm Evaluation Platform (AEP), based on the ADSP2186 DSP and AD1819 codec is available. Further details of the AEP can be found on the ClearSpeech AEP Fact Sheet. In addition, executables for certain AD and TI evaluation platforms are available. Further details can be found on our website.

Speech in Noise Detector, a noise-robust voice activity detector producing a binary value and an audio output for which non-speech segments have been muted.

Line Echo Cancellation, which removes electrical echo caused by 2-4 wire hybrids in telephone networks.

Adaptive Noise Suppressor, which reduces signals that are below a given threshold.

For Additional Information

Contact sales@nctclearspeech.com.

Other ClearSpeech Products

AEC is part of the ClearSpeech suite of algorithms for enhancing voice communications by removal of unwanted noise. Other algorithms in the suite are:

Adaptive Speech Filter, which removes background 'stationary' noise from microphone signals

Adaptive Speech Filter II, which removes unwanted broadband 'stationary' noise from speech

Referenced Noise Filter, which removes noise where a reference signal from the noise producing source is available.

Intelligent Squelch Filter, which reduces unwanted signals such as pops and pre-speech noise experienced in some radio communications.

Patent 6,091,813 - Acoustic Echo Canceller - July 18, 2000
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