ClearSpeech® – acoustic echo cancellation

for improved intelligibility and clarity in communication applications

NCT Group, Inc. is a supplier of voice enhancement software and hardware products. ClearSpeech®-Acoustic Echo Cancellation (AEC) is an algorithm designed to remove far-end acoustic echoes in hands-free full-duplex communication systems. Currently, most of the hands-free communication devices in the cellular and computer telephone industries continue to use a half-duplex audio channel to ensure the suppression of echoes. However, this results in unnatural and difficult communication where only one speaker at a time may speak and the beginning and/or end of sentences are truncated.

Acoustic echoes are produced by the open-air acoustic path between the loudspeaker and microphone. NCTs ClearSpeech-AEC is an adaptive, frequency-block LMS algorithm that continuously tracks and updates the changes in the acoustic path between the loudspeaker and the microphone to eliminate the acoustic echo at the source. The algorithm can be changed to accommodate different audio bandwidths and acoustic tail lengths for use in a variety of applications.

ClearSpeech-AEC can also be integrated with NCTs ClearSpeech-Adaptive Speech Filter (ASF), a patented adaptive noise reduction algorithm that removes stationary or near stationary noise such as computer fans, office machines, HVAC and background babble from speech. The ASF algorithm performs two functions; to remove noise and to act as an additional non-linear processor to improve echo cancellation performance.

Features/specifications

- Developed as platform independent ANSI C code
- Designed as a re-entrant subroutine call
- Integrates with ClearSpeech ASF
- Continuous and adaptive removal of acoustic echo from far end speech
- Improves voice quality
- ITU-T G.167 Compatible
- Meets GSM time delay requirements
- Minimizes acoustic design of audio equipment and conference rooms
- Variable voice performance span – (0 to 8kHz)
- Enhanced double talk
- Fixed and floating-point versions
- Comfort noise to enhance listener comfort

Echo cancellation performance characteristics for 64 ms AEC

- 300 to 3400 Hz voice bandwidth
- Convergence time < 1 sec
- Convergence rate 40 dB/s
- ERLE > 50 dB
- No attenuation

Hands-free applications

- Two-way radio
- Cellular telephone (AMPS, GSM, TDMA, CDMA)
- Audio and video teleconferencing
- Intercom systems
- Computer telephony
- Computer gaming
- Voice recognition preprocessor

Demonstration and development platforms available

- ADSP-2181 EZ-Kit Lite Platform for fixed point applications
- ADDS-2106X EZ Lite platform for floating point applications
- ClearSpeech®-PC/COM Full Developer's Kit for PC applications

For additional information

ClearSpeech can also be ported to other platforms having the appropriate memory requirements.

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Music, deafness & vibration

A recent study revealed that deaf people sense vibration in the part of the brain usually used for hearing. "The experience deaf people have when 'feeling' music is similar to the experience other people have when hearing music," said Dr Dean Shibata, of the University of Washington, who presented his work to the latest meeting of the Radiological Society of North America in Chicago. "The perception of the musical vibrations by the deaf is likely every bit as real as the equivalent sounds, since they are ultimately processed in the same part of the brain." Dr Shibata used a brain scanning method called functional magnetic resonance imaging to compare brain activity between 10 deaf volunteers and 11 volunteers with normal hearing while subjected to intermittent vibrations on their hands. Both groups showed activity in the part of the brain that normally processes vibrations. But, unlike those with normal hearing, the deaf students showed brain activity in a golf ball-sized area, the auditory cortex, otherwise usually only active during auditory stimulation. Dr Shibata said the research was important because it suggested that it might be helpful to expose deaf children to music early in life so that their brain music centres could have the stimulus to develop. Evelyn Glennie, profoundly deaf but also a virtuoso percussionist, spent time when she was young refining her ability to detect vibrations, standing with her hands against the classroom wall while her percussion teacher Ron Forbes played notes on the timpani.

Military uproar

There was general merriment at the Army's expense recently when it was revealed that noise levels generated by military bands were under scrutiny. However, there was a serious point to the story because the Army has long lived with the potential dangers of excessively loud noises. Artillerymen, in particular, are subjected to the explosive concussion of their big guns, and their hearing has to be protected accordingly. Deafness among old gunners, sometimes manifesting itself years after they have hung up their uniforms, has long been a source of concern. Analysis of noise levels is all part of the Army health and safety officer's job. One unusual aspect of this work was the research carried out at military dog kennels in Germany. It was found that on a bad day the din created by barking at the Defence Animal Search Unit at Sennelager could be a real problem for kennel maids. Forty howling canines – the dogs are used to guard military installations and sniff out explosives – in a relatively confined space can raise the noise levels above 100 decibels – potentially dangerous for humans and probably not very good for the dogs themselves.