MELP
(Mixed-Excitation Linear Predictive) Coder
by Atlanta Signal Processors, Inc.

Software Overview

Atlanta Signal Processors is now offering a newly-revised and enhanced high-quality very-low-bit-rate speech coder, the MELP (Mixed-Excitation Linear Predictive) coder for the Texas Instruments TMS320C3x DSP. The MELP coder is well suited for applications where high intelligibility at lower bit-rates is required. It offers the highest speech quality at data rates from 1.6 kbps to 2.4 kbps. In formal listening tests, the MELP coder has been shown to be clearly superior to similar LPC coders with a binary voicing decision and no mixed-excitation.

The new enhanced MELP features improvements in several areas. The representation of the spectral parameters of the speech model has been made more efficient through highly-optimized vector quantization. Fourier magnitude coefficients have been added to the spectral modelling process to improve the quality of the coded speech for low-pitched speakers and in the presence of background noise. Improvements have been made in the bandpass voicing mixtures to enhance the naturalness and fidelity of the coded speech.

Traditional pitched-excited LPC coders use either a periodic pulse train or white noise as the excitation for an all-pole synthesis filter. These vocoders produce intelligible speech at very-low-bit-rates, but they sometimes sound mechanical or buzzy and are prone to annoying thumps and tonal noises. These problems arise from the inability of a simple pulse train to reproduce all kinds of voiced speech. The MELP coder uses a mixed-excitation model that can produce more natural sounding speech because it can represent a richer ensemble of possible speech characteristics. The MELP coder is also robust in difficult background-noise environments such as those frequently encountered in commercial and military communication systems.

Features and Benefits

• High-quality at very-low bit-rates
• C callable
Processor and System Specifications

- Texas Instruments TMS320C3x, operating at 50 MHz or above.
- Memory requirements, program: 15.3 k × 32-bit off-chip RAM
- Memory requirements, data: 1130 × 32 on-chip RAM plus 4.8 k × 32-bit off-chip RAM
- 50-MHz ‘C3x utilization, full duplex: 82% at 2.4 kbps
- 50-MHz ‘C3x utilization, encode: 59% at 2.4 kbps
- 50-MHz ‘C3x utilization, decode: 23% at 2.4 kbps

Usage Limitations or Performance Considerations

- None

Algorithm Verification

- In formal listening tests, the 2.4-kbps MELP coder received a Diagnostic Acceptability Score which was ten points higher than the Department of Defense (DoD) standard LPC-10e coder operating at the same rate, and which was statistically indistinguishable from that of the DoD FS-1016 CELP standard operating at 4,800 bps.

Availability

- The MELP coder algorithm is available under a non-exclusive worldwide non-transferrable license under a royalty basis. This license allows the algorithm to be incorporated into any of your company’s products.
- An audio cassette containing a demonstration of the MELP coder is also available. The tape includes noisy environments (government-standard noise conditions) and clean speech.

Company Background and Contact Information

Atlanta Signal Processors was founded in 1981 by Ronald W. Schafer, Thomas P. Barnwell III, and Russell M. Mersereau, three Professors of Electrical Engineering at the Georgia Institute of Technology with over 80 years of experience in the field. The company has focused its efforts on developing tools for professional signal-processing design engineers and now offers digital signal-processing hardware and software products to DSP designers worldwide.

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