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ITU G.726 Speech Coder



Processor

Texas Instruments TMS320C6000 DSP range.

Background

The algorithm implemented is the ITU-T recommendation G.726 variable rate audio coder. The encoder compresses narrowband audio data in A-law, μ -law or linear formats, at a sample rate of 8kHz, to data rates of 16 000, 24 000, 32 000 or 40 000 bps. G.726 supersedes G.721 and G.723, as the G.726 specification at 32 000 and 40 000 bps is identical to G.721 (32 000 bps only) and G.723 (32 000 and 40 000 bps).

G.726 is used in speech compression for speech storage, digital circuit multiplication and telephony multiplexing applications where the delay must be kept low to avoid side tone echo problems.

Features and Performance

- TI eXpressDSP™ Compliant software available
- 12 channels of G.726 on 200MHz device
- Less than 7Kbytes program memory required
- Awaiting further optimisation
- Passes all ITU-T test vectors

G.726	Program Memory		Data Memory			Interrupt Latency (Cycles)	Typical call Period (ms)	Processing Load (MHz)
	Code (Kbytes)	Tables (Kbytes)	Static Memory		Stack Memory (Kbytes)			
			Heap (Kbytes)	Tables (Kbytes)				
Encoder	4.0	0.05	n * 0.1	1.3	0.1	20	10	n* 7.5
Decoder	5.5	0.05	n * 0.1	0.3	0.1	20	10	n* 8.2
Encoder + Decoder	6.6	0.10	n * 0.1	1.3	0.1	20	10	n* 15.7

Table 1 : Current DSP Requirements G.726

Note: Processing loads quote worst-case scenarios with n representing the number of channels. Program memory table values are initialisation values. Kbytes equals 1024 bytes.

Technical Notes

The software is written using only fixed-point instructions and is compatible with both the TMS320C6000 fixed-point family and the TMS320C6700 floating-point family. It is supplied in both big-endian and little-endian variants.

The main application of 24 000 and 16 000 bps channels is for overload channels carrying voice in Digital Circuit Multiplication Equipment (DCME). The 40 000 bps channel is to carry data modem signals in DCME, especially for modems operating at greater than 4 800 bps. G.726 is now also widely used for Voice over DSL applications. The G.726 specification uses an Adaptive Differential Pulse Code Modulation (ADPCM) algorithm. An important feature is that the coding/decoding delay is essentially zero, as the algorithm processes one sample at a time.

The performance at the various bit rates for a single encode/decode is judged to be as follows:

40 000 bps	Identical to 64 000 bps PCM (G.711) for audio - passes 9 600 bps modem signals
32 000 bps	Identical to 64 000 bps PCM for audio
24 000 bps	Some degradation from 64 000 bps PCM for audio
16 000 bps	Considerable degradation from 64 000 bps PCM for audio but still intelligible

Interface Details

The eXpressDSP™ G.726 software uses the IG726 interface specified by Texas Instruments in the eXpressDSP™ developers' kit.

The software is also available in a non-eXpressDSP version with a basic multi-channel interface. The DSP requirements for this version are similar to those given in Table 1.

Availability

The code is available now, for a one-off payment and/or royalties depending on the commercial application.

Software for the TMS320C6000 is available for a full range of vocoders including G.711, G.722, G.723.1, G.728, G.729, G.729A, G.729B, G.729AB and for other communication algorithms.

SIGNALS+SOFTWARE

SIGNALS+SOFTWARE was founded in 1992 as a developer of high quality Digital Signal Processing application software for the communications industry. Supplying to a whole range of customers, including large blue chip corporations, **SIGNALS+SOFTWARE** has quickly established itself as the world leader in DSP software design and production.

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