SIGNALS+SOFTWARE

Data Sheet

IS-641A TDMA Speech Coder
(Incorporating AMR-GSM and EFR-GSM)

STARCORE™

Processor

Motorola StarCore™ MSC8101 & MSC8102 DSP.

Background

SIGNALS+SOFTWARE are developing a complete suite of communication software for the Motorola MSC8100 family of DSPs. The initial development platform, the MSC8101, utilizes the StarCore™ 140 four ALU (Algorithmic Logic Unit) DSP core. This device also has 512kb memory and a Communications Processor Module (CPM) making it a versatile device for communication applications.

The algorithm to be implemented is the TIA/EIA recommendation IS-641-A TDMA, a fixed rate speech coder. The encoder compresses speech input data in a 16-bit uniform Pulse Code Modulated (PCM) format, at a sample rate of 8k samples per second (128k bps) to a fixed bit rate of 7400 bps. The 20ms speech frames (160 samples) are processed by a Code Excited Linear Prediction (CELP) encoding process in which the fixed codebook employs the Algebraic Code Excited Linear Prediction (ACELP) codebook structure. IS-641-A also uses short-term post-filtering.

The IS-641-A TDMA algorithm implements silence compression techniques to reduce the transmitted bit rate during the silent intervals of speech. Systems allowing discontinuous transmission (DTX) are based on Voice Activity Detection (VAD) algorithm and a Comfort Noise Generator (CNG) algorithm that allows the insertion of Silence Insertion Descriptor (SID) frames during the silence intervals. This also gives the additional advantage of using lower processing loads and bandwidth resource of the DSP during silence frames.

Features and Performance

- Integrated AMR-GSM and EFR-GSM functionality.
- Both Subscriber and Infrastructure IS-641A solutions are available.

AMR-GSM	Program Memory (Kbytes)	Tables (Kbytes)	Stack (Kbytes)	Data Memory (Kbytes)	Processing Load (MHz)
Encoder	74.6	28.0	6.3	n * 3.3	n * 5.63
Decoder	35.7	26.9	1.5	n * 1.6	n * 1.08
Encoder + Decoder	104.5	29.1	6.3	n * 5.0	n * 6.71

Table 1 : DSP Requirements for IS-641A - Infrastructure Solution

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

Technical Notes

The operation of the IS-641-A algorithm is essentially based on the analysis-by-synthesis method for minimising a residual signal. This is done by choosing a codebook vector which, when passed through a long-term pitch filter

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and a short-term linear predictive filter, will be as close to the original signal as possible. The term close, in this case, refers to perceptual audible difference rather than a mathematical subtraction. The parameters of the model are obtained by quantisation of the pitch filter coefficients, linear predictive filter coefficients (LPC) and codebook information. These are transmitted over the channel once per frame, each of which consists of 160 samples (20ms of speech).

Interface Details

For convenience the individual software functions are supplied as a single library module. The library contains all the object code that is required to link in to a user's top-level application code. The audio functions are either callable as C functions or as assembly functions.

Availability

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

Also available or in development for StarCore™ are a full range of vocoders including FR-GSM, AMR-GSM, EFR-GSM as well as 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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