Measured Channel Frequency Response From 8192 Channel Spectrometer

The measured channel frequency response from the 8192-channel **Spectrometer**.

quency resolution, dynamic range, and accumulation length when compared to previous versions. An alternate, dual-polarization, 1.5-GHz, 4096-channel spectrometer is available as well. Both designs are capable of accumulating for hours, several orders of magnitude over what is required.

In addition, a further improved spectrometer with double the frequency resolution, a polyphase-FIR filter front end, and substantially reduced noise has been successfully simulated and is presently in the final stages of development. When finished, it will offer a spectrometer developed on Virtex-5 hardware with bandwidth and spectral resolution an order of magnitude greater than the analog spectrometers presently in use.

Plans to make an 8-GHz spectrometer taking advantage of the same technology used for this device are already being made. Finally, efforts are presently being made to interface this design to a compact Nallatech board, which consumes less power and can be more readily used in remote locations and demanding environments.

This work was done by Robert F. Jarnot of Caltech and Ryan M. Monroe of Georgia Tech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-48352

Small Aircraft Data Distribution System
NASA's Jet Propulsion Laboratory, Pasadena, California

The CARVE Small Aircraft Data Distribution System acquires the aircraft location and attitude data that is required by the various programs running on a distributed network. This system distributes the data it acquires to the data acquisition programs for inclusion in their data files.

It uses UDP (User Datagram Protocol) to broadcast data over a LAN (Local Area Network) to any programs that might have a use for the data. The program is easily adaptable to acquire additional data and log that data to disk.

The current version also drives displays using precision pitch and roll information to aid the pilot in maintaining a level-level attitude for radar/radiometer mapping beyond the degree available by flying visually or using a standard gyro-driven attitude indicator.

The software is designed to acquire an array of data to help the mission manager make real-time decisions as to the effectiveness of the flight. This data is displayed for the mission manager and broadcast to the other experiments on the aircraft for inclusion in their data

files. The program also drives real-time precision pitch and roll displays for the pilot and copilot to aid them in maintaining the desired attitude, when required, during data acquisition on mapping lines.

This work was done by Seth L. Chazanoff and Steven J. Dinardo of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-48384.

Earth Science Datacasting v2.0
NASA's Jet Propulsion Laboratory, Pasadena, California

The Datacasting software, which consists of a server and a client, has been developed as part of the Earth Science (ES) Datacasting project. The goal of ES Datacasting is to provide scientists the ability to automatically and continuously download Earth science data that meets a precise, predefined need, and then to instantaneously visualize it on a local computer. This is achieved by applying

the concept of podcasting to deliver science data over the Internet using RSS (Really Simple Syndication) XML feeds. By extending the RSS specification, scientists can filter a feed and only download the files that are required for a particular application (for example, only files that contain information about a particular event, such as a hurricane or flood). The extension also provides the

ability for the client to understand the format of the data and visualize the information locally.

The server part enables a data provider to create and serve basic Datacasting (RSS-based) feeds. The user can subscribe to any number of feeds, view the information related to each item contained within a feed (including browse pre-made images),

manually download files associated with items, and place these files in a local store.

The client-server architecture enables users to:
- Subscribe and interpret multiple Datacasting feeds (same look and feel as a typical mail client),
- Maintain a list of all items within each feed,
- Enable filtering on the lists based on different metadata attributes contained within the feed (list will reference only data files of interest),
- Visualize the reference data and associated metadata,
- Download files referenced within the list, and
- Automatically download files as new items become available.

❯ Algorithm for Compressing Time-Series Data
This algorithm is generally applicable to many types of data.

Goddard Space Flight Center, Greenbelt, Maryland

An algorithm based on Chebyshev polynomials effects lossy compression of time-series data or other one-dimensional data streams (e.g., spectral data) that are arranged in blocks for sequential transmission. The algorithm was developed for use in transmitting data from spacecraft scientific instruments to Earth stations. In spite of its lossy nature, the algorithm preserves the information needed for scientific analysis. The algorithm is computationally simple, yet compresses data streams by factors much greater than two. The algorithm is not restricted to spacecraft or scientific uses: it is applicable to time-series data in general. The algorithm can also be applied to general multidimensional data that have been converted to time-series data, a typical example being image data acquired by raster scanning. However, unlike most prior image-data-compression algorithms, this algorithm neither depends on nor exploits the two-dimensional spatial correlations that are generally present in images.

In order to understand the essence of this compression algorithm, it is necessary to understand that the net effect of this algorithm and the associated decompression algorithm is to approximate the original stream of data as a sequence of finite series of Chebyshev polynomials. For the purpose of this algorithm, a block of data or interval of time for which a Chebyshev polynomial series is fitted to the original data is denoted a fitting interval. Chebyshev approximation has two properties that make it particularly effective for compressing serial data streams with minimal loss of scientific information: The errors associated with a Chebyshev approximation are nearly uniformly distributed over the fitting interval (this is
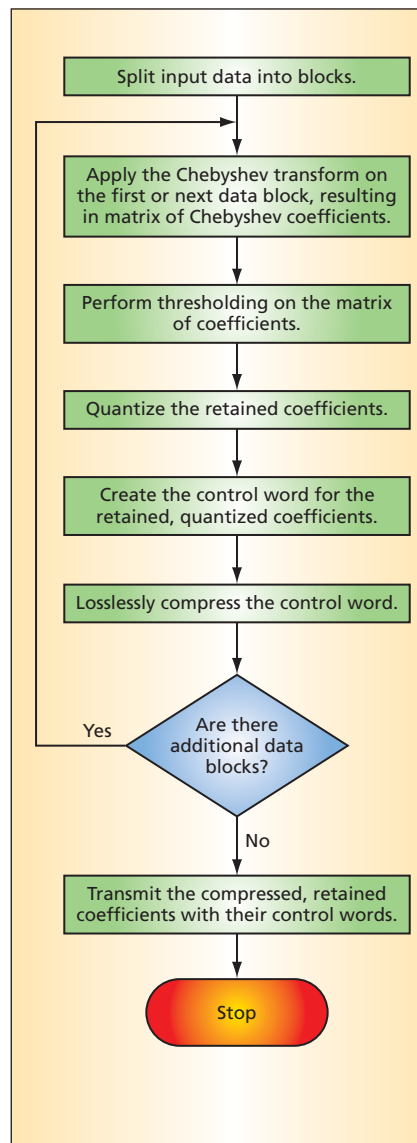
Chebyshev Transforms are calculated in this algorithm, which effects lossy compression of data. Parameters of the algorithm can be adjusted to balance accuracy versus degree of compression.

known in the art as the "equal error property"); and the maximum deviations of the fitted Chebyshev polynomial from the original data have the smallest possible values (this is known in the art as the "min-max property").

The algorithm performs the same sequence of calculations on each successive data block (see figure). For each block, the first step is a calculation of a Chebyshev transform; that is, a matrix of coefficients of a Chebyshev series. This involves calculation of linear combinations of data samples with the applicable Chebyshev coefficients. The Chebyshev coefficients are fixed and known, making it possible to reduce the computational burden by computing them in advance, storing them in lookup tables, and retrieving them from the lookup tables as needed. In the next step, the matrix of coefficients is thresholded: only those coefficients larger than a threshold specified by the user are retained. The retained coefficients are then quantized to reduce their representations to no more than a number of bits specified by the user.

Next, there is generated a bit-control word, which is to be used during the subsequent decompression process to indicate the locations for insertion of the quantized retained coefficients and for insertion of place holders (zeroes) at locations of coefficients that are not retained. The bit-control word is then encoded by a lossless compression technique; this step can significantly increase the overall compression ratio without introducing additional loss. If there are more data blocks to be processed, then the process as described thus far is repeated for the next block. If there are no more blocks to be processed, the compressed data and their control words are transmitted.