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DATA-ACQUISITION TECHNIQUES ARE CHANGING SO RAPIDLY THESE DAYS THAT IT IS DIFFICULT TO SUMMARIZE ALL THE POSSIBILITIES. SOME TIME AGO THESE TECHNIQUES WERE RESERVED FOR COMPUTER PROFESSIONALS WHO USED assembly language and arcane technical information to produce packages that were hard to modify and understand. However, the field is gradually becoming more user-friendly, making it more accessible to those who use data acquisition but are not professional programmers. It is possible now to program many acquisition cards in the C language, and the visual LabView language developed by National Instruments is becoming a de facto standard.

Educational apparatus producers such as Pasco have developed their own menu-driven, graphical user interfaces. For many people who use mathematics-oriented fourth-generation languages such as Matlab, Scilab, Maple, or Mathematica (and often don’t know C), it is convenient to be able to insert data directly into these work environments. This trend has already begun, as Mathworks provides an interface to some acquisition cards, and some digital signal processor card manufacturers provide a software interface to Matlab.

We really appreciated the toolbox’s easy installation and integration into Matlab. We found the RTT instruction for student laboratories better than prepackaged menu-driven applications where the student cannot see how things work and does not know what to do if he needs a feature not on the menu or if the acquisition system changes.

RTT operation is based on two concepts—timer and history. The timer is meant to read or write a single instantaneous value on the acquisition card, while the history is an array of values read or written with a user-specified timing. You can use timers and histories in Matlab by copying them onto single variables and arrays, respectively.

We tested and used in a physics laboratory course a simple software package called Real Time Toolbox 3.0 that allows us to interface Matlab with more than 100 types of the most common data-acquisition cards. Humusoft, a small independent firm in the Czech republic, developed RTT 3.0. The whole, extended software package, including drivers for several specific cards, takes about 900 KB and occupies less than one disk.

Product information

The Real Time Toolbox 3.0 for Matlab and Simulink is produced by Humusoft in Praha, Czech Republic (info@humusoft.cz; http://www.humusoft.cz). The educational price of the extended RTT package is $595 (plus $595 for a classroom license). The price includes the drivers for most interface cards. Humusoft also produces data acquisition cards, which are sold at a 50% discount if purchased with RTT. The software is available for Windows 95, 98, or NT (no Unix or Mac versions), and requires Matlab 5.3 and Simulink 3.0. In the US and most European countries, it is sold directly by Humusoft.
speed of the Matlab interpreter. The maximum frequency is, at best, a few hundred hertz. DMA can also be used to record or produce signals faster than 66 kHz, at the card’s clock speed. Among the supported acquisition cards, the fastest has a 1.25 MHz clock.

Beginners can use the RTT commands without arguments; a window appears where users can enter parameters by ticking desired options or typing numerical values, which allows oscilloscope-type signal monitoring. With more experience, users can learn to write Matlab/RTT programs with the scripted language's full power.

The extended RTT package contains the RTT block library, which provides input and output blocks for use with Simulink, Matlab’s graphic extension for system simulation. You just add the real-time blocks to the Simulink diagram and set the driver parameters to get an interface with the real world. There are standard blocks for real-time control where the processing is done immediately at each sample (for example, when Matlab is able to do the calculation in a single sampling time), and buffered blocks for faster sampling rates when data are stored in a buffer for later processing.

Serial communication through an RS232 port is also possible and straightforward as an independent section of the software. In practice, communicating with an I/O buffer is similar to the standard operation of reading from and writing to a file.

We have done multiple experiments with the RTT extended package, including:

- producing arbitrary waveforms,
- analyzing a system’s response,
- making a PID control of a system,
- measuring time intervals, and
- interfacing with instruments through RS232.

For more details and software examples, you can look at Humusoft’s Web site, http://www.humusoft.cz, where you can also download a demo version of the software. We have often asked Humusoft questions by e-mail and received appropriate help.

In the future, Mathworks will introduce a new toolbox with functions similar to the basic RTT (without Simulink) and Humusoft will continue to sell only the extended RTT package with the block library.

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**Technical News Briefs**

**Wolfram releases Mathematica 4**

Wolfram Research has announced a new release of the comprehensive mathematical and numerical analysis program Mathematica. Improvements include extensive speed increases, more import/export file formats, extended HTML, LaTeX and Tex output capabilities, and improved data-analysis functions. A new packed array data format stores two to five times as many data points in the same memory space and many large-scale numerical calculations run up to 10 times faster. Symbolic calculation users will not see as dramatic a speed increase, but there are new features in the Simplify and FunctionExpand functions and improved integration and differentiation options that might make the upgrade worthwhile. Interestingly, the Save As menu also includes a MathML option. (Hopefully, our Web browsers will be able to handle this in the near future!) I also noted that Wolfram fixed a problem with the results of the V3 nonlinear fitting programs. The notebook interface now includes a spell checker plus support for Chinese and Korean characters, and Windows and Mac users can utilize limited support for real-time 3D graphics. You can find more information at Wolfram Research, 100 Trade Center Drive, Champaign, IL, 61820-7237, phone +1-800-WOLFRAM; http://www.wolfram.com.

**ESDU provides comprehensive engineering design tools**

Engineering Sciences Data Unit
provides an online library of more than 200 volumes of engineering design data, containing over 1,200 validated design guides in many fields of mechanical, structural, chemical, and aerospace engineering. The ESDU data items are produced and validated under the guidance of committees of independent international experts from industry, research, and academia. Subscribers can download Acrobat PDF files of the guides and Fortran77 source code for the supporting software (which may be user modified), plus interfaces that make it easy to run the code on common software platforms. Subscriptions ($500 and up depending on field and options chosen) also include support from ESDU experts.


Input utility converts serial data to keystrokes
Anyone who finds themselves typing data from an electronic instrument into a computer program should investigate WinWedge 32 Pro, an interesting product from TAL Technologies that can convert serial data from any RS232 instrument into “keystrokes” and automatically “type” the data into any Windows application. WinWedge can support up to 100 serial ports simultaneously, including devices hooked up over an Ethernet or the Internet and can also transmit data via DDE to desired locations in the destination application. WinWedge 32 Pro costs $495; WinWedge 1.2 (with fewer options and supported devices) is $199. For more information, contact TAL Technologies Inc., 2027 Wallace St., Philadelphia, Pa. 19130, phone +215-763-7900; sales@taltech.com, http://www.taltech.com.

Mathtools announces Matlab and Excel enhancements
MIDEVA 4.5 is a complete, powerful environment for developing and running scientific applications that includes an m-files interpreter, debugger, editor, profiler, and optimizer, providing a modern environment for Matlab development. The new MIDEVA version includes a greatly improved user interface, better Matlab compatibility, easy creation of standalone applications, and a major speed improvement. The price for a commercial, professional license is $999; the academic license is $299.

They have also developed a Toolbox Accelerator for signal processing that accelerates programs using Matlab. The higher performance is obtained by compiling the toolbox m-files into fast MEX files. The acceleration is transparent, as the accelerated MEX files are used automatically. A typical compiled MEX routine runs twice as fast as the interpreted m-file. A single license of the Toolbox Accelerator is $299; an academic license is $149. MatriXL, a library of matrix math functions for Microsoft Excel, is also available from Mathtools. It includes more than 400 functions with the library, including FFT and inverse FFT (both one and two dimensional); eigenvalue computation; linear system solution; bessel, bit, beta, and gamma functions; matrix exponentials; 1D and 2D interpolation; and polynomial fitting and evaluation. This package enhances Excel spreadsheets by giving advanced numeric capabilities not previously available in Excel. MatriXL is based on the well-tested Matrix<LIB> scientific library, used within other Mathtools products. The price for a single license is $99; an academic license is $49.

You can download fully functional, time-limited evaluation copies of each of these products free of charge from the Mathtools Web site, http://www.mathtools.com. For more information, contact info@mathtools.com or David Edwards, Mathtools Ltd., PO Box 784, Ft. Washington, PA 19034-7084.
New BBEdit 5.1 supports Perl
Bare Bones Software has announced the release of BBEdit 5.1, a new version of the well-known Macintosh HTML and text-editing tool. Version 5.0 had improved HTML editing tools, including tag-editing features and a SGML parser. A Set Menu Keys command enabled users to configure keyboard equivalents to menu items, and new filters and options were added to an already comprehensive multifile search. Additional support for syntax coloring and navigation for JavaScript, Perl, and Cumulus are also provided in this version.

The 5.1 editor now integrates support for Perl, the programming language invented by Larry Wall that is widely used for text manipulation and Common Gateway Interface processing on Web sites. BBEdit 5.1 includes facilities to help develop and debug Perl scripts. In addition, users can create “Perl filters” to process text in open-document windows and can access frequently-used Perl scripts from a dedicated menu. Web site developers can also use Perl in conjunction with BBEdit’s automated HTML document-management tools for increased flexibility in generating Web content. The update also adds support for Apple’s Projector source code control system as well as other tools. The update is free of charge to BBEdit 5 owners at http://web.barebones.com/products/bbedit/rnotes.html. Recommended retail price is $119. You can also find information on cross upgrading from other HTML editing products at Bare Bones Software, P.O. Box 1048, Bedford, MA 01730; http://web.barebones.com.

Statistica neural networks updated
Statsoft Inc. recently announced the upcoming release of Statistica Neural Networks, version 4, featuring a new intelligent problem solver (IPS) network wizard and a multitude of new statistics, charting options, and training algorithms. The main new feature, the IPS wizard, takes a unique approach to neural networks analysis by automating the most difficult problems involved in neural network analysis: feature and network-architecture selection. Statistica Neural Networks is a Windows application that can be used as a stand-alone program, but also integrates with the Statistica statistics and graphing software. For more information or to download a demonstration CD, visit the Statsoft Inc. at http://www.statsoft.com or contact StatSoft, Inc. at 2300 E. 14th St., Tulsa, OK, phone +918-749-1119.

Datel releases streaming PCI data-acquisition board
A four-channel analog input board designed with an emphasis on high-speed streaming of A/D samples has been announced by Datel Inc. The PCI-416M uses a 32-bit architecture, and all four ±10-V low-noise 16-bit channels can be simultaneously sampled at up to 200 kHz. Incorporating a pretrigger buffer and a unique “banked” FIFO, the board can move two A/D words in each 32-bit transfer. Menu-driven software is available for Windows 95 and NT, DOS, Hyperception, and Labview, and the board includes a programmable 24-bit parallel I/O and analog threshold trigger. Contact Datel Inc., 11 Cabot Boulevard, Mansfield, Mass. 02048-1151, phone +508-339-3000; http://www.datel.com.

High-accuracy liquid level gauge for large tanks
Gauging Systems Inc. announced a new float-acted liquid level gauge for tanks up to 99 feet depth with a claimed accuracy of 1/8 inch. Model GSI-2570 is available in kit form or as a gauge head for the direct replacement of older depth gauges. Several options help combat hang-ups, moisture, and condensation and can adapt to pelletized or granular as well as liquid products. Contact Gauging Systems Inc., PO Box 680, Sugar Land, Texas 77478, phone +800-444-1327; GSIHouTx@msn.com.

O-Matrix adds interprocess communication
O-Matrix 4, from Harmonic Software Inc., is the newest version of this high-performance data analysis and visualization program. This release introduces new client–server capabilities that enable O-Matrix to communicate with other Windows programs. For example, Harmonic has used the new interprocess capabilities to develop a Mathlink package for communicating with Mathematica, allowing O-Matrix users to leverage Mathematica’s specialized symbolic computation and visualization advantages from within O-Matrix. For further information, contact Harmonic Software Inc., PO Box 31537, Seattle, Wash. 98103, phone +206-367-8742; harmonic@omatrix.com; http://www.omatrix.com.